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UNDERGROUND GASIFICATION

THE subject of underground gasification continues to intrigue chemists and engineers because of its difficulties and of the apparent advantages that would accrue from a successful solution of the problems involved. In recent issues we have given the considered opinion of many British thinkers in this field, and these in general are not favourable to the prospects of the process in this country. So far as we can see at the moment, and in the present development of the process, it would be very difficult indeed to select British coal seams that would be suitable for the process. It is understood that there will be an opportunity of trying the experiment on a practical scale in this country at a later date, but although many plans have been made, it is unlikely that the experiment will be carried out in the immediate future.

In spite of the volume of expert opinion against it, there are, however, general reasons in favour of the process if it could be conducted successfully. Perhaps the greatest of all is the reduction in manpower needed for the production of coal. At such a time as this, production of coal ranks very high indeed in the list of national priorities. Without adequate supplies of fuel the manufacturing operations of the country cannot be carried on. Labour is the greatest single factor in coal production whether it be in the increase of coal raised per man-hour or in the total increase of coal by the whole labour force. It is significant that the Russians have reported that the output of heat per man employed is increased seven-fold or eight-fold by underground gasification as compared with the normal method of coal mining. The men employed comprise a much higher proportion of technicians than in normal mining practice so that the advantage is more apparent than real until the men have been trained—the lack of sufficient trained men is likely to be a handicap in many directions in this country during the next few years. Still, a nucleus of skilled engineers and chemists could no doubt soon train the unskilled in the practical application of the technique—when the proper technique is discovered. The real difficulty is that the right technique for British coals, if it is discovered, cannot be put into practice until long after the present coal shortage has disappeared; it is a long-term policy, and must be developed and judged on its economic merits and not upon its effect on our immediate difficulties.

It is frequently argued that underground gasification must be wasteful because the efficiency of gasification is very low. That may be so, though like most processes the thermal efficiency may be capable of improvement. There is, to be sure, a wide gap between the efficiency of gasification underground and that of total gasification of the coal when it has been raised to the surface. Underground gasification leaves large quantities of semi-coke in the mine that are unlikely ever to be raised to the surface. To that extent its efficiency is reduced and we should doubt whether the efficiency expressed as therms available at the surface divided by therms in the coal seam is greater than 25 or 30%. But those who maintain that this absurdly low efficiency represents a wasteful use of coal should ponder on mining technique as disclosed by a former President of the Institution of Mining Engineers, the late Forster Brown (Presidential Address, March, 1940): "The fundamental factors (in the exploitation of a coal seam) are the cost of production and the quality of the coal produced. The result, at all events in this country, is that in the majority of cases many millions of tons are left unworked in collieries which have been closed down and abandoned, owing to its having been found economically impracticable to continue working them for one or other, or a combination of reasons." Examples were given in this Address of four collieries in which the coal left unworked amount to between 52 and 91% of the coal existing in the seams—an "efficiency of production" of 4 to 9%! As the depths increase, the proportion of coal left unworked will become greater still. There are always losses associated with coal handling and cleaning. Moreover, if this coal is to be converted into gas after being brought to the surface, the efficiency of gasification must be taken into account. By present-day standards it would, therefore, be fair to reduce the "efficiency of gas production" from seam to gas (producer gas or coal gas) as an average of not more than about 40%; this is not so much greater than that secured by underground gasification even in the present state of the art as to rule the method out of court. On the contrary it will be an incentive to further efforts. The view has been expressed that already it is cheaper to produce electrical power at the pithead by a power station based on underground gasification than by the accepted method. Whether this is true we shall not presume to say, but we understand that more than one paper on this subject of underground gasification may be presented to the World Power Conference at The Hague in September, and we shall be disappointed if the economics of the process are not discussed there.

Cheap Oxygen

Fundamentally, the production of suitable gas by underground gasification is bound up with the cost at which industrial oxygen can be supplied in large quantities. The views were expressed at the International Conference on Pure and Applied Chemistry that (a) cheap oxygen is just round the corner and (b) that oxygen cheap enough to be used industrially for combustion and gasification will not be secured for many years. Oxygen is generally made by liquefaction of air and this is a process that entails considerable power costs; the cost of production depends upon the cost of power. If the cost of power for the process can be materially reduced, there is reasonable expectation of cheap oxygen. It is suggested that the cheap oxygen claimed to have been produced industrially in the United States has been secured by a considerable increase in the scale of production. As the scale increases, the cost diminishes, but beyond a certain limit it may be expected that this decrease

will lie almost entirely in the reduction of capital and labour costs, and ultimately even labour costs will not decrease further. The decrease in costs owing to the scale of operations is thus mainly in the subsidiary items and it is difficult to see how the main cost, power, will be greatly reduced by increasing scale of production. The cheap oxygen plants in other parts of the world—there seem to be none in this country—appear to owe their success mainly to a reduction in the cost of power per unit because the power is generated from some other process as a by-product. The argument comes back to the old one; the "cheap power" countries based on water power can operate processes that this country cannot touch. Each country has its opportunities according to its local conditions; and equally there are processes that are denied to each country by reason of those same local conditions. We have to cut our cloth according to what is available. Just at present our underground gasification cloth is not sufficient to make us a suit. But means may be found to stretch it that little bit more, and if that can be done, we shall have to face the situation and all that it entails. It will certainly bring about a pretty considerable modification of our ideas upon the location of power stations and other works, and its repercussions on the Gas Industry will be considerable.

OUT OF EVIL

THE belief, prevalent among the pious, that good can come out of evil, is not so much a hackneyed piece of wishful-thinking as a somewhat abused truism. World War II, generally agreed upon as one of the greatest evils suffered by mankind, is not without its meagre benefits. The word "compensations" can hardly be applied, for surely nothing can compensate for mass suffering; rather let us say that through the pain, destruction, and futility we have learned certain lessons which, if we take the trouble, can assist us in the future. For example, only a blitz of the magnitude suffered by London and other great cities could show us with any degree of accuracy what types of building are able to withstand extreme stress and strain. Theoretical knowledge proved faulty.

The foregoing line of thought finds its application in our own Industry. Replacement and renovation of plant was reduced to a minimum and faults became apparent which, under normal working conditions, would never have a chance to appear. That is the crux of the matter: allowing plant to deteriorate has not only exaggerated those weak spots with which most engineers were conversant, it has brought to light weaknesses never before suspected. And the lessons to be learned are not limited to manufacturing and distributing plant; they apply no less to ordinary domestic appliances, which have received limited attention from the undertaking as a result of direct complaints, or none at all, due to the appliance functioning reasonably satisfactorily. Here, then, is a Heaven-sent opportunity to find out exactly where these weak spots occurred and how they may be avoided in the future. We wonder how many undertakings have taken a census of the appliances on their district and their consumers' attitude towards them. News of some schemes directed towards this end has reached us, and among them special mention must be made of the North Middlesex Gas Company, which recently undertook a detailed appliance survey, carried out on somewhat novel lines, and embracing special measures to ensure accuracy. It is interesting to examine the manner in which the task was undertaken.

Broadly speaking, there are four points to remember: (i) If the householder is notified in advance of the examination, the appliance may not be discovered in its normal condition; (ii) the appliance must be thoroughly examined, a process entailing complete or partial dismantling; (iii) this necessitates a man with both the required technical ability and reasonably long experience; (iv) the investigator's report must be accurate and the standards to which he works must be identical with those of his colleagues. To meet these demands the North Middlesex Company selected their fitters with care, grouped them six per foreman, explained what was wanted, gave them preliminary talks to ensure that their methods of assessing performance and condition were alike, supplied a work ticket so designed as to obtain the maximum factual information, and visited 1,200 households on the district, during which operation fitters met for periodical discussions. The results obtained were carefully tabulated and serve as an almost unique guide to appliance performance and longevity.

The range of appliances embraced by the scheme included cookers, fires, water heaters, wash boilers and washing machines, radiators, refrigerators, and various sundries. It is of interest to examine some of the comments upon the results. In particular we would single out the detrimental effect of grease deposits in and around the burner air ports on cookers. Those designs which have burners in an upright position suffered from choked burner orifices, due to spillage and droppings. When these ovens were equipped with gate-type shelf racks, the results were particularly bad, and in one modern design of oven in which the burners were mounted in a trough, a few months' use was sufficient to block air entry to the burner. It was found that consumers did not remove oven burners for cleaning because of replacement difficulties.

Among water heaters combustion faults were usually attributable to over-gassing or partial blockages in the combustion products path through the appliance. Intra-flame contact was not uncommon, frequently caused by deposits falling on the burner and blocking the holes. It is significant that drilled burners were the greatest culprits. Greasy and fluffy deposits on the underside of and between burner components were noticed on heaters fixed close to cookers, resulting in partial blockage of air supply. We have been told that the older type single-point water heater was found to be less prone to bad combustion than the modern appliance, the more roomy design ensuring efficient combustion for longer periods. The older models were again more fortunate in the matter of verdigris deposits, the modern multi-point being addicted to this fault. The report contains some valuable notes on a special sub-investigation made to determine the condition of the waterways of circulators. Of 18 such appliances examined, with an average age of nine years, of which 12 had received no attention since installation, the combustion was judged to be good in 11 cases, fair in six, and bad in only one. The good-fair-bad assessment of the interior gas section was 5-7-5, and that of the heat exchanger, 7-8-3; the waterway showed deposits of $\frac{1}{8}$-$\frac{3}{8}$ in. in three cases, $\frac{1}{4}$ in. or less in seven, and in the remaining eight cases deposit was negligible. The thermostat worked satisfactorily in 15 cases. The comments upon these appliances may be briefly stated as follows: localized scale formation, usually on or above the waterway sections on the exterior of which heat exchanger fins were affixed; loose rust in horizontal connexions, particularly where hot water from the boiler circulated through the gas appliance; corrosion deposits and kitchen grease restricted air supply; soft solder heat exchanger fin fixings on older models burnt when scale deposits caused a higher fin temperature; capsule-type thermostats tired when maintained closed for long periods by hot water from the solid fuel system; time wasted by draining down and filling whole water installations where no stopcock was fitted to the cold feed; none of the appliances, which were mostly fixed by builders, possessed flues.

We have quoted some of the results of this survey report and have selected certain items for special mention for a three-fold purpose: (i) to give some indication of the type of information it contained; (ii) to underline those salient points most likely to concern readers; and (iii) to serve as a stimulation towards further surveys of a similar kind. A widespread series of investigations in districts both lar

and small a store of information may be harvested of inestimable value to manufacturers and the distribution and sales staffs of gas undertakings. The North Middlesex Gas Company has done the Industry considerable service in arranging its results in a readily readable form and it is our belief that the presentation of the entire report in "GAS SERVICE" will ensure that maximum use is made of that information. The first instalment will appear in the September issue.

Commentary by "Abaris"

N.G.B. or C.G.B. ?

What's in a name ? asked Shakespeare, and we may very well ask the self-same question at this time. Is it to be National Gas Board or Central Gas Board ? And now, having asked you to consider the query, I shall endeavour to make a case for one of them.

Over the years, we have become accustomed to thinking in terms of National objects such as butter, conscience, eggs, milk, debts, coal and a string of other worthy edibles, usables and deplorables. There is a patriotic implication in the word national, regardless of the country of origin*, that strikes me as being part now, of our heritage. The attachment of the handle national, suggests that the object so described has some peculiar merit which should enhance the value and make the object far more desirable.

Whereas the awful word, "Central," means little beyond the fact that there must be a circle somewhere; a circle round whose circumference one may walk aimlessly for hours and days. I have in mind the borough's Central Library, usually full of exhausted gentlemen, and ladies, who hibernate therein to the discomfort of those who thirst for knowledge. I, personally, do not like the word "central" in any shape or form; and I am sure, if you can cast your mind back into the past, you too will discover that you have never met with anything reasonably central, or centrally reasonable. I hope the meaning is quite clear.

Therefore we must bear together to see, and ensure, that the syllables "National" do appear in front of our own Gas cabinet's title. There is an additional reason that I almost overlooked. If the headquarters is in London, the new title will fit admirably in the telephone directory among the 1819 other "National" something or others, thus making it a round figure of 1820 °

Deliberat Roma, perit Saguntum

I was talking recently with a visitor from Belgium, and he could hardly believe that this country is importing coal. With truly continental logic, he argued that one could not sell ice to a productive ice factory. All I could say was that if the ice factory were Government controlled, then you could sell it ice, frost, and anything else that seemed frigid. I added that the present ice factory owners were open to buy anything; but sound advice, from those who understood ice and all its ways, was not sought either gratuitously or for money. This is modern economic thought.

In Belgium, they are getting coal though the distributive systems are still a bit creaky; their miners are working hard and spending hard in both ordinary and black markets. Eggs and butter are plentiful, at a price, and eating presents few problems to the population. This, mind you, in a country that was fully occupied by the Hun.

Last winter, things were terrible in Europe, and most of the heating and cooking had to be done with wood. In Belgium gas was used only at meal times.

Meanwhile coals from America and some from Poland are being unloaded in our ports; but this does not guarantee that all households will get even the ration they were led to believe they should expect before Christmas. Our astute politicians blame private enterprise for our plight, yet they have the effrontery to buy liberally from the U.S.A, practically the last remaining stronghold of private enterprise and individualism.

Ruskin, in his essay, "Ad Valorem" says, "Note, finally, that all effectual advancement towards this true felicity of the human race must be by the individual, not public, effort." Surely this holds good to-day.

Enough, but if we go as we are at the moment we shall have to import brains also, to take over the Government; that is why I say that while the doctors deliberate the patient dies.

* England, N. Ireland, Scotland, and Wales.

Housing

We, as an Industry, know something about housing, for we have had some 135 years of experience in heating, lighting, cooking, and ventilation. During this long period we have competed successfully with coal, electricity, and oil and still carry an enormous domestic and industrial load that is of paramount importance to our national economy.

Only a few days ago, I visited some friends in their very modern flat. Yes, they had an electric cooker all right, and perched atop was the nastiest looking gas ring you ever did see. This ring is overworked because it is convenient, quick, and flexible ; it can simmer very nicely.

The planners of that luxury block of flats allowed tenants a choice of fuels, but not so a large number of housing authorities, to-day; not much. The hutches they plant out at the ratepayers' expense contain fabulous kitchen equipment, by to-day's standards; the hutches themselves are costly and in a very large number of instances the authorities put in only electricity. The cost of putting in two services, we are told would be far too expensive; in fact, prohibitive ! Yet, oh crying shame, these same electric cookers will stay cool for a hefty part of this winter and the inhabitants will find their immersion heaters gripped by ice.

This loading of the market, even with only two additional electric cookers, is so incredibly stupid that—well it is just incredible. A cold, miserable body demands hot foods when frost is in the air; and the throat needs hot drinks when that clammy mist obscures all. But the wretch who perforce has to hire one of these houses will have no cooking alternatives, unless he has the foresight to get a paraffin cooker now. Assuming that he can buy the necessary liquid fuel also.

Truly the blind are leading the blind to-day; but where on earth are they leading them to ? I frankly wouldn't know.

No Windows

Man had no glass windows for many, many centuries, so the Liverpool Gas Company are not indulging in a radically new building process in blocking up certain works windows. The subject has raised some dust, for a debate was started and we shall hear more before the year is out; it is good to commence a cogitation in the Industry on a subject other than nationalization.

Windows are a nuisance if they require much maintenance, whether it be repairing, painting and/or cleaning; and a gas-works is no place for anything which requires frequent attention by labour that could be otherwise more productively employed. Merely to brick in existing window spaces, however, seems an odd makeshifty method of obliteration, because the spaces bricked in will not tone in with the old brickwork for years. Buildings are sure to appear very patchy and untidy.

First we should consider the effect on the employees in the blacked-out building. The dayshift is going to have all the interior appearance of a nightshift, and many a man will miss the small amount of natural light that struggled through the dusty windows. As long as there are no claustrophobics there should be few objections; provided the ventilation is good and the artificial lighting beyond reproach, there is very little else to worry about.

Second, many gas-works take regular parties of visitors on conducted tours; visitors are bound to remark on the way in which windows are blocked, and guides will have to explain why. The average human being is so used to seeing windows and glass that he will assuredly question with sympathy those who work behind flat, dark walls. I would therefore suggest that the bricking in of windows be done so as to deceive the eye; to mislead it into seeing a window which is not a window.

And this particularly if the affected building can be seen by people on the public highway.

Underground Gasification

Russia is always in the news these days. Her leading diplomats are negativists; her leading politicians are collectivists; and the bulk of her nationals are communists, if we are to believe *Pravda*. This is all big stuff. But Russia also gets a mention every time anyone opens his mouth to talk about district heating; and the audience listens, enrapt, to a system which is merely chicken feed in those frigid areas.

Recently, learned chemists heard about underground gasification as it applied to the U.S.S.R., and we had the pleasure of listening to the tongue-twisters that define most of the towns and cities in that Union. Yes, chemists have no monopoly of the syllables that dislocate the jaw and demoralize an audience ! Russia can afford to gasify underground, for her potential resources are enormous in that mighty, unfriendly, and cold land-mass. Prodigality is only to be expected in the circumstances. We, in this country, have enjoyed the

old days of waste and now must get down to the job of trying to exist economically.

Our coal-bearing areas are riddled with a maze of workings from which generations have torn out the coals; our seams are liable to penetration by fire-damp and therefore, explosions. Uncontrollable underground fires are the last thing we want; and any further waste must be avoided at all costs. Let us assume that we have to gasify underground. Where is all the gas going? Through thousands of miles of mains, and through hundreds of pumping stations. Nearly all of 700,000 miners will be thrown out of work; in fact, there will be complete chaos if we go in for the system on an all-England scale. The only major benefit would be the silencing of some of the gentlemen who stand up so often to contradict each other on public and other platforms.

And so the International Congress of Pure and Applied Chemistry talked the matter out; as they say in Russia, "Nichevo", meaning usually, never mind.

Letters to the Editor

Letters After Names

DEAR SIR.—May I ask through your columns why the current 'Shorter Edition" of Whitaker's Almanack, just published, does not nclude in its valuable section "Abbreviations in Common Use", reference to the Chartered Institution of Gas Engineers?

Yours faithfully,
"PARTIAL STICKLER."

London.
Aug. 25, 1947.

(Perhaps it is a question of modesty on the part of the Institution, though we think omission of reference is to be regretted in view of the numerous other engineering, scientific, and technical bodies, &c., mentioned in the "Abbreviations" section of Whitaker for 1947. Incidentally the Chartered Institute of Fuel is also missing, though the appropriate abbreviations are given for "leg before wicket" and General Post Office.—Ed. "G.J.")

High-Pressure Gasholders

DEAR SIR.— In the Paper by Messrs. Noone and Grant, Fig. 1 gives data relating to typical installations, and I was curious enough to see whether any relationship exists between a ton of steel and free available storage it will provide. I had always assumed (in my ignorance) that the amount would show no substantial variation, and that the thickness of metal would increase with the diameter and pressure, and thus, within limits, the capital cost of providing storage per unit of gas would be constant, seeing that cost is approximately dependent on tonnage.

It is surprising, therefore, to note that the storage per ton of steel varies fron 700 to 1,500 cu.ft. and there is no clue in the figures to indicate whether size, or pressure, or ratio of length to diameter has any bearing on the matter. Would it be too much trouble for the Authors to explain whether the difference is due to local conditions or whether there is any pointer to indicate the economical size.

In the case of the low pressure holder, the position is simple. The larger the holder, the cheaper does it become per unit of storage and the less weight of steel is required. The following is an extract from some of the figures available from my records (in all cases the weight of steel tanks is included.)

Size of Holder Cu.ft.	Storage in Cu.ft. per ton of Steel.
15,000	440
50,000	660
100,000	800
420,000	950
600,000	1,350
1,000,000	1,510
1,200,000	1,380
1,250,000	1,610
1,500,000	1,500 and 2,000
2,100,000	1,570
3,750,000	1,870
4,000,000	2,400

These results are fairly consistent, having regard to the variations in the number of lifts and the proportions. The tank usually accounts for about 40% of the total weight.

Mr. Gill's letter in your issue of Aug. 20, prompts a further suggestion. We have had his Paper on the experiences of various users in the Severn Valley and allied group. Then this year we have the Paper giving the fundamentals of engineering design and practice. Could we now have a Paper on the economics of gas storage by both systems? The storage on the works would need different consideration from that on the district because of the different functions, but the works could be treated from two angles:

(a) for pure emergency,

(b) for regular use (to a limited extent) of the normal output.

To mention two extremes, if all the gas were compressed and then released at low pressure the cost would be high and certainly more than low pressure storage (as far as running cost is concerned). If on the other hand a high pressure vessel only came into operation a couple of times during the season, the running cost would be low, but it might be argued that the need for additional storage in such circumstances is doubtful.

In the case of district holders variations would be more complex, dependent (for example) on whether additional mainlaying would be avoided by the installation of a holder in general, or a pressure holder in particular.

We must not forget that mains, holders, and compressors are merely variations of methods of storage and transmitting gas.

Yours faithfully,
"ENGINEER."

Aug. 22, 1947.

Personal

MR. J. W. RAINE, Chief Chemist of the Darlington Gas Department, has resigned to take up an appointment with the Stretford and District Gas Board.

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Dr. R. LONG, B.Sc., A.R.I.C., Assoc. M.Inst.Gas E., at present a member of the staff of the Joint Research Committee of the Gas Research Board and the University of Leeds, has been appointed Lecturer in Fuel in the Department of Chemical Engineering of the University of Birmingham.

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Sir GEOFFREY PETO and Mr. C. W. SPIERS have retired from the Board of the Morgan Crucible Company, Ltd., after serving the Company for nearly 50 years. Mr. J. WALKER, a senior member of the technical staff, who has been with the Company since 1929, has been appointed a Director.

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MR. THOMAS S. SCOTT, who has been Technical Assistant to the Johnstone Gas Department for 14 months, has been appointed Engineer and Manager of the Linlithgow Gas Company, in succession to Mr. J. McPherson, whose appointment as Engineer and Manager of the Carnoustie Gas Department has already been announced.

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MR. ROBERT SCOTT, for 42 years Gas Manager at Blantyre, Lanarkshire, has retired. When the late Mr. William Scott, Manager at Blantyre for 13 years, died in 1905, his son was appointed to succeed him. A native of Motherwell, Mr. Scott is 65 and a keen sportsman. He hopes to take up the breeding of budgerigars extensively as a pastime.

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MR. STANLEY HOPKINSON, F.S.C., F.I.A.M.A., Public Relations Officer to the Liverpool Gas Company, has resigned from the Secretaryship of the North Western District, British Gas Council. He retains his Chairmanship of the Film Committee and membership of the Publicity and Exhibitions Committees of the Council, but is concentrating on developing the Public Relations Services of the Liverpool Gas Development Centre, in which there are 30 subscribing undertakings. The new Secretary of the N.W. District is Mr. JOHN GRAYSTON, Engineer, General Manager, and Clerk to the Stretford & District Gas Board.

GERMAN AND JAPANESE INDUSTRIES

Various branches of industry are catered for in the latest series of German and Japanese industrial reports. These publications, which describe German and Japanese wartime processes, are available for purchase at the Sales Offices of H.M. Stationery Office or may be ordered by post from the Cashier, H.M.S.O., P.O.Box 569, London, S.E.1. Copies are also supplied to the chief libraries, some chambers of commerce, to universities, professional and scientific institutions, and trade associations.

Report on German industry are prepared by Allied Industrialists (mainly British and American) selected for their specialized knowledge, who were sent to Germany under the auspices first of the Combined Intelligence Objectives Sub-Committee and subsequently of the British Intelligence Objectives Sub-Committeee and its American counterpart, the Field Information Agency, Technical. Reports on Japanese industry are almost exclusively from American sources and are in most cases compiled by teams of United States Service Personnel, and readers are reminded that many of these reports are of a preliminary nature and do not go into great detail.

The B.I.O.S. Information Section, 37, Bryanston Square, London, W.1, invites enquiries about German and Japanese technical processes covered in these reports, which include the following: B.I.O.S. 1939 "The Production of Carbon Black from Carbon Monoxide" (1s. 6d., postage 1d.), J.I.O.A. 80 Pierre Demart. "Underground Gasification of Coal" (1s., postage 1d.).

News in Brief

Cork Gas Consumers' Company has declared an interim dividend of 3% for the year ending Dec. 31, 1947.

Use of the Aerodrome Site at White Lund as the site for joint gas-works for Morecambe and Lancaster has been approved by Lancaster City Council.

The **Plymouth and Stonehouse Gas Light and Coke Company** has circularized organizations in the district offering to place the services of its cookery demonstrator, Miss K. Jenkin, at their disposal for lectures during the approaching winter.

Civic Employees in Glasgow number one in 20 of the population. During the past financial year the Corporation paid £16,147,993 in wages to 58,963 employees. This was an increase of £2,201,595 in the total pay-roll and an increase of 2,055 in the number of employees.

To **Meet the Increased Demand for Gas,** Elgin Gas Department has placed orders for new plant amounting to over £30,000. Work will shortly commence on a new half million cu.ft., welded gasholder, which will be the first of its kind erected in Scotland by the Oxley Engineering Co., Ltd. Provision has also been made for a new Bryan Donkin steam reciprocating compressor, and also a new Waller Rootes type exhauster.

Modern Gas Heating Appliances designed to meet particular domestic needs are a feature of the *News of the World* Home Making Exhibition now touring the provinces. One notable display comprises the C.P. convector heater, providing safe economical heating for the play-kitchen, and the Warwick portable gas fire in a study-bed-sitting-room, both manufactured by Cowper, Penfold, & Co., Ltd. The exhibit also includes a new design in boiling burners, and a gas poker.

By the End of the Year eight of the 14 open-hearth furnaces belonging to Messrs. Steel, Peach, and Toezer, at Templebrough, near Rotherham (the largest smelting shop in Europe), will be operating on oil. Of 21 steel-making furnaces, the firm will have converted ten to liquid oil burning in the next few months. When the conversion plant is completed it is stated that coal consumption will be halved. The firm has the assurance of the Ministries of Fuel and Supply that liquid fuel will be available for the programme laid down. Much of the plant being used for oil burning has been obtained from dismantled warships.

In Common with other gas undertakings throughout the country, the City of Coventry Gas Department is co-operating in the Ministry of Fuel and Power's Gas and Electricity Economy Campaign. Although certain guidance and advice is given by the Ministry on the formation and function of the campaign, it was felt that some basic scheme should be available, and at the request of the Mayor of Coventry, a chart was evolved by the Coventry undertaking for presentation to inaugural meetings, &c., and for the eventual guidance of all concerned, when the campaign was launched. The Ministry has now requested that the chart be used in the various Regional Schemes.

The Price of Gas is to remain unchanged at Glasgow for the current year despite increases in costs. When the Gas Committee considered the estimates for 1947-48. Bailie Sam Leitch, Convener, stated that the present price of 4s. 1d. per 1000 cu.ft. to ordinary domestic consumers would remain unaltered, although the proposed increase in rail rates would add approximately £20,000 to the department's annual coal bill. Cost of coal, he added, was now 120% above the 1939 level, whereas the price of gas in Glasgow had been increased in the period by only 36%. Since 1939 the overall consumption of gas in Glasgow had risen by 24% and the domestic consumption by 35%.

A **Fuel Advice Bureau** sponsored by the Cambridge Fuel Advice Committee was recently opened by the Mayor of Cambridge in premises situated in the centre of the town. The window display was a composite effort on the part of the Cambridge University and Town Gas Light Company and the local Electricity Company, and made a striking appeal directed towards the efficient use of fuel as a means of effecting economies which, if adopted throughout the country, would result in saving the required 2½ millions of tons of coal during the summer months by domestic consumers. This Bureau was the first of its kind to be opened in the Eastern Area, and was staffed by representatives of the Gas Company and the Electricity Company. During the week, a large number of enquiries were received, and sound guidance and assistance given on a variety of fuel problems. In one instance, the Gas Company's staff provided a secondary school teacher with a large model meter index and a quantity of meter index cards for use in instructing her pupils in the reading of meters. A representative of the Ministry of Fuel and Power inspected the Bureau during the week and expressed her satisfaction and appreciation of the planning and labour which had been expended in setting up the Bureau.

Darlington Town Council has applied for sanction to borrow £20,000 for gas mains extensions to various housing sites.

Dundee Gas Committee reports that agreement has been reached on the route over the Tay Bridge for a 9 in. main to supply Newport, (Fife), with gas in bulk and the estimate of the cost is awaited from Stewarts & Lloyds, Ltd.

The Metropolitan Gas Company of Melbourne has informed Messrs. William Coward & Co., Ltd., by cable that the net profits for the year ended June 30, was £104,984. The final dividend is 5s. sterling, and the balance carried forward is £35,829.

Middlesbrough Gas Department has received sanction from the Ministry of Fuel and Power to lay a 24 in. gas main. The laying of the main will be done by direct labour, and Cochrane and Co., Ltd., Middlesbrough, will supply the pipes and specials.

Mr. W. H. Wintringham, Chairman of the Great Grimsby Gas Company, performed the opening ceremony in connexion with the new sports ground laid out in Peaks Lane, Grimsby, for the use of the Company's employees. This new sports ground replaces the former ground in Railto Avenue, Grimsby.

Gas was Strongly Represented in the *News of the World* Home Making Exhibition held at the Royal Horticultural Society's Old Hall in Westminster. This exhibition is now being staged at the Albert Hall Institute, Nottingham, It then goes to Bradford and thereafter the itinerary is Leeds, Birmingham, Newcastle, Liverpool.

Diary

Sept. 3.—B. G. C. Gas Salesmen's Circle (South-Western District): Annual General Meeting, Showrooms of the Taunton and District Gas Company, 2.30 p.m.

Sept. 8.—London and Counties Coke Association: Technical Committee, Gas Industry House, 2.30 p.m.

Sept. 9.—British Gas Council: Central Board, Gas Industry House, 2.30 p.m.

Sept. 9.—National Federation of Gas Coke Associations: General Committee, Gas Industry House, 10 a.m.

Sept. 11.—North British Association of Gas Managers: Annual General Meeting, Town Hall, St. Andrews. (Golf and bowling competitions, Sept. 10; annual excursion, Pitlochry, Sept. 12).

Sept. 12.—Manchester District Association of Gas Engineers: Visit to Stanton Ironworks, near Nottingham.

Sept. 15.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m. Gas Industry House.

Sept. 15-19.—Association of Public Lighting Engineers: Nineteenth Annual Meeting and Conference, Southport.

Sept. 16.—National Federation of Gas Coke Associations: National Technical Committee, Gas Industry House, 11.30 a.m.

Sept. 16.—B.G.C. Gas Salesmen's Circle (Scotland, Western District). Meeting at Ascot Gas Water Heaters, Ltd., 137, Sauchiehall Street, Glasgow, 5 p.m. Paper by R. J. Gregg "Survey for Salesmen."

Sept. 16.—Solid Smokeless Fuels Federation: Technical Committee, Gas Industry House, 2.45 p.m.

Sept. 20.—Manchester and District Junior Gas Association: Extraordinary General Meeting, Gas Showrooms, Manchester, 2.30 p.m.

Sept. 24.—B. G. C. Domestic Development Committee, Gas Industry House, 10.30 a.m.

Sept. 24-25.—Institute of Statutory Inspectors of Gas Meters: Annual Conference, Royal Pavilion, Brighton. "History and Development of Wet Meters," B. R. Parkinson; "Gas Meters in the British Zone of Germany and in Berlin," M. W. Jones (Gas Testing Branch, Ministry of Fuel and Power).

Oct. 1.—Wales and Monmouthshire Association of Gas Engineers and Managers: General Meeting, Llandrindod Wells (preceded on Sept. 30 by Golf Competition on Llandrindod Wells Golf Course).

Oct. 2.—Solid Smokeless Fuels Federation: Executive Committee, Dorchester Hotel, Park Lane, W.1., 11.30 a.m.

Oct. 20.—London and Counties Coke Association: Annual Luncheon 1 for 1.15 p.m.; Annual General Meeting, 2.45 p.m. Grosvenor House, Park Lane, W.1.

Oct. 28.—Southern Association of Gas Engineers and Managers: Annual General Meeting, Connaught Rooms, Kingsway, London. 2.30 p.m. (Preceded by Council Meeting, 11 a.m.; Luncheon, 1 p.m.)

Nov. 25-26.—Institution of Gas Engineers: 13th Autumn Reasearch Meeting, London.

WHERE HAVE WE GONE ASTRAY?

[FROM A SPECIAL CORRESPONDENT]

LAST November, a business colleague made with great emphasis the statement that within twelve months Britain would be facing a first class economic crisis, and now we have official confirmation of that prophecy. The person mentioned made no claim to powers as a visionary for many had seen the writing on the wall and formed similar, if vaguer, ideas along the same lines, so it is hardly correct to say that the storm has sprung up without adequate warning. The cry of " Produce more and more " is sounded now with greater intensity and vigour but this alone will not effect miracles, for those who forecast the crisis were generally those who had their fingers on the pulse of commercial activity and their counter-cry was " How, when supplies are being cut each period ? " In other words, the prevailing propaganda by poster, article, and broadcast has missed fire, and one of the first tasks the Government will have to face is a full analysis of the reasons.

The immediate causes are not difficult to discover. The employer who started his post-war plans with enthusiasm is now thwarted from time to time by shortages of most kinds of materials. Certain items are becoming so desparately difficult to obtain, particularly steel for constructional purposes, that it is not worth while for some firms to put forward concrete schemes. Moreover, to be told to wait for several months before one can even contemplate an expansion scheme and to know that in the meanwhile valuable overseas markets are being lost, is enough to damp the enthusiasm of most entrepreneurs. Lack of the best equipment leads to inefficient operation, bad conditions and irritation on all sides, and in this respect it may be that the short term export programme as it affects mining and textile machinery in particular may have to be revised in the light of urgent home demands.

The Drive for Production

From the operatives' point of view, the drive for production has even less significance; in fact to many it is entirely without point. This is not an unqualified condemnation of the attitude as one of blindness, stupidity, or ignorance, for there are reasons which make it at least understandable. Many workers, from the point of view of wage levels, are far better off than they have been for years, although the lack of consumer goods is obviously an adverse factor in calculating comparisons in the standard of living. And yet the persistent cry is still for more wages and shorter working hours ! While this demand may not be very illogical, it is not necessarily good national policy, and there has been a disturbing reluctance on the part of the Government to discuss a wages policy, even during the recent crisis debates.

The individual standpoint can be summarized briefly as follows. Higher wages may be reflection of a desire to maintain a higher standard of living, but it may also be an attempt to discover how far the management can be prevailed upon to share out as wages a greater proportion of the gross income of the firm. For other workers who are aware of the periodic bottlenecks and shortages of raw materials, the prospect of working longer hours and increasing production leads them to fear that they will be unemployed all the sooner, or at best subject to " concealed unemployment." This point of view has been expressed by the building trade workers, in particular, for it is in their industry that the use of substitutes has generally produced fresh shortages in the substitutes themselves.

Incentives

Alongside these factors, however, is the much debated question of incentives. Perhaps in no previous generation has this psychological " unknown " in production been discussed with so much heat—and so little result. The proposed solutions have ranged from vague threats to the more concrete possibilities of income tax reliefs, extra food and special bonuses, but none of these appears to contain the elements of even a palliative, let alone a cure, for they do not reach the seat of the trouble. Incentives will rarely have any effect upon a worker who considers himself " better off " than before and foresees no immediate difficulty in maintaining his accepted standard of living. In such cases (and where the pace of the worker is not set by a machine) inducements are not only meaningless but potentially dangerous, for they may result in increasing lack of confidence on the part of the worker towards the management and the authorities making the policy.

The central problem facing the country at the present moment, then, is not purely economic but also moral, and the most disturbing feature of all is the apparent unwillingness of the majority of the people to accept those responsibilities, individual and collective, upon which the whole edifice of social welfare and progress is built. A year ago, such a statement would have been condemned by many as a rash and unjustified generalization, but the events of the last few months alone have led to its wider acceptance. The light-hearted disregard of official agreements between employers and employed and the consequent " unofficial " strikes are illustrations of this social malaise. The fact that in some unions the rank and file have little faith in their own elected leaders indicates a failure on the part of the leaders themselves and also in those who could bear the burden but do not wish to inconvenience themselves. Perhaps it is old-fashioned to mention the word " duty " in these cynical, hard-boiled days, but past generations did find an unusual source of strength in it in times of stress and strain. To-day, the emphasis is on self and not service, and on the corollary of something for nothing. One can only hope that this is a passing phase, a post-war reaction which can, and will, be corrected by common sense and sound direction from the central authorities. Nevertheless, the disease is widespread, and the assertion I heard from a graduate of a well-known university that he had no responsibilities to anyone or to the State but that the State had clearly defined duties towards him, is echoed in words and actions by many thousands more up and down the country.

Moral and Economic Factors

It would be wrong, however, to assume that moral and economic factors are in watertight compartments; both are inextricably linked together, and woven into a complicated pattern of historical and international relationships. The fact that this country has weathered past crises without any undue lowering of the standard of living has led many to assume that this present one will be overcome in some mysterious way with similar absence of a fundamental change in our way of life, and this is a particularly dangerous form of complacency since conditions are not as favourable to us as they were in the 1920's or 1930's. The critics of the American loan on the grounds that it would drug the nation into a sense of false values have undoubtedly won their point, but the error and blame cannot be laid entirely at the door of the electorate. True enough, there have been warnings from time to time by some responsible leaders, but the fact remains there was no common voice from the top and no united attempt to face the inevitable issues.

So far the analysis has been along what are fairly orthodox lines. The next step is to try and work out what can be salvaged from the wreckage and indicate a possible line of advance. Apart from a few restrictive measures and a long term plan for agriculture, little has come yet from the Government in the way of guidance, although we may expect more in the near future. What must be avoided at all costs is a series of panic measures designed to switch production at short notice to " essential " lines, but which might cause unnecessary harm and dislocation of the whole industrial machine. For instance, the technical difficulties of concentrating steel production on any one or more types of output are great enough without trying to rush the change over. Similarly, it is no good making " equitable " cuts in coal and power for all non-priority industry when such a step would mean that some units would have just enough to keep the plant in running order but none for actual production. This danger is particularly applicable to continuous process industries, such as chemicals and glass. The first step must be a well defined statement of policy, preferably made in conjunction with the leaders of the industries concerned, and then a series of detailed plans worked out by specialists and technicians.

As far as the operative labour is concerned, there must be a radical change in the Government's attitude towards wages and incentives. Any appeal to work harder or longer must be given with the reminder that all round wage increases cannot be considered, or at least not for some considerable time. The equally unpleasant fact should also be made abundantly clear, that whereas in the past two years, incentives have been given before they have been *earned*, in future any such benefits cannot be contemplated before output in the industry in question has reached a given target. In other words, the sweets must no longer be a bribe but a reward when the goal is won. The same attitude must be taken towards the whole of the elaborate Social Security scheme to which many are looking forward. If the costs cannot be borne out of current income then they must be earned before they can be issued as benefits. This sounds like nineteenth century housekeeping, no doubt, to many workers for the social cause, but when our assets are fast dwindling, a little prudence might pay bigger dividends in the long run. The nation was described in the House a few days ago as a ship overtaken by a storm. If this is a true simile, then the only way to ride the tempest is to heave to and face the danger squarely; to run before it is to invite disaster. The next three months should show fairly clearly what are our chances of survival.

Over 85% of the New Houses going up at Nottingham are fitted with gas appliances, said Mr. E. Bates, Sales and Fittings Superintendent of the Nottingham Gas Department, when a presentation was made to Mr. Harry Jeffries, Housing Clerk of the Department, who is leaving. Much of the credit, said Mr. Bates, was due to Mr. Jeffries, who began with the Department as a junior 16 years ago. The presentation, subscribed for by the staff and fellow-workers of the Department, was made by the Engineer and Manager, Mr. R. M. Wilkinson.

VISIT TO WATSON HOUSE

A large number of members of the Finsbury Borough Council recently paid a visit to the Watson House laboratories of the Gas Light and Coke Company. The party accompanied the Mayor (Councillor Mrs. R. Curtis, J.P.), and were shown the importance of gas in new housing and in conversions, and how gas and coke appliances are tested.

The Mayor of Finsbury (Mrs. R. Curtis, J.P.), Mr. G. C. Holliday, Mrs. G. Jamieson (Mayor's Secretary), Councillor Mrs. Bromfield, and Alderman N. Gold.

MEASURING TEMPERATURE

The third edition of that standard work by Dr. Ezer Griffiths on "Methods of Measuring Temperature" is to be greatly welcomed. Former editions of this work have proved of incalculable usefulness to thousands of students not only in universities and technical colleges, but also in the harder realm of industry. The new edition has been revised and reset. Its 223 pages include 91 illustrations and 56 tables. The publishers are Charles Griffin & Co., Ltd., and the price is 20s. net.

"MIDGAS" HOLIDAY CAMP

The problem of looking after young entrants to the Gas Industry so that they may in time become matured, loyal, and capable workers is receiving much thought at the present time. It is difficult to attract young people into the Industry, and, having done so, it is frequently difficult to retain them. Improved forms of social welfare and instruction are necessary, and effective contact between employee and employer must be made. It was this conviction which prompted the North Middlesex Gas Company to provide last year a holiday camp at Dover for apprentices in the Company's employ. The venture was an undoubted success, and with increased confidence and energy, was repeated this year, the boys spending the Bank Holiday week under canvas at Little Farthingloe, Dover.

The camp itself, christened the "Midgas Boy's Holiday Camp," provides accommodation for 24 boys and four officers. The eight bell tents, marquee, and other equipment, valued at over £350, were hired from the Army authorities, while the cookhouse was actually the original cricket pavilion from the Company's sports ground, altered, sectionalized, transported, and erected in new guise. Each tent was named after a ship and the occupants formed teams to compete in the varied sports programme. Swimming facilities were good, Shakespeare Bay being within easy reach, and football, handball, and cricket vied with each other for popularity; during the week a cricket match was played against a Dover Gas Company team.

The most important day of the week was Aug. 6, when 32 parents, in addition to other visitors, inspected the camp. Particular mention should be made of Mr. F. Dawson, Engineer and General Manager of the North Middlesex Gas Company, Mr. J. H. Dyde, Director, Engineer and General Manager of the Slough Gas and Coke Company, Mr. H. A. Probin, London Secretary of the North Middlesex Gas Company and General Manager of the South-Eastern Gas Corporation, and Mr. R. G. A. Clark, Engineer and General Manager of the Dover Gas Company, all of whom expressed their interest in the camp and were impressed with its efficiency. Together with Mr H. R. Hart, Sales and Service Manager of the Company, who organized the camp, they took part in some of the games with the boys and during their short stay entered thoroughly into the friendly and informal atmosphere pervading the camp.

The use of the camp may be extended to other Companies and this method of cementing goodwill between undertaking and staff may be more widely adopted. Not only does such a venture improve an undertaking's relations with its younger employees; the parents are also consulted and their co-operation enlisted—an important point at the present time.

JUNIOR ASSOCIATIONS' ACTIVITIES

The September issue of "Gas" completes Volume No. 1 of our monthly paper devoted exclusively to the interests of the Junior Gas Associations. The issue covers the remainder of the proceedings of the Associations up to the end of the 1946-1947 session and the first full year's index reflects the wide field covered by the Juniors during what was, in practice, the first normal post-war session.

Business and Social

The Wales and Monmouthshire Junior Gas Association at its annual meeting agreed to admit to membership members of the technical staffs of coke oven plants supplying gas to undertakings. The Yorkshire Junior Gas Association's President's Day took the form of a visit to York, with a morning inspection of the Monksbridge Gas-Works and an afternoon tour of the Castle Museum and the Kirk collection.

High Wycombe Developments

The Paper by J. R. Owen on "Some Recent Developments at High Wycombe Works" to the London and Southern District Junior Gas Association—the first half of which was published in the August issue—includes a description of the airborne sealing system which has been in successful operation at High Wycombe for nearly two years. The Author also includes details of the steps taken to meet the new problem of the disposal of the oil gas tar formed as the result of the increase in the production of carburetted water gas.

Retrospect and Prospect

The Presidential Address of F. H. Nicholls to the Yorkshire Junior Gas Association is largely a retrospect of the past season's Papers and discussions, from which he draws lessons for the future. He expresses the opinion that each man should be trained for more than one job to increase his sense of "belonging" to his undertaking; that a good worker appreciates proper supervision while a poor worker needs it; and that by welding the whole of the personnel, skilled and unskilled, into a coherent group some contribution can be made to the solution of the enormous problems, both material and personal, which confront the country to-day.

Effect of the Fuel Crisis

A. W. Richards and A. V. S. Hutchins, of the Neath Corporation Gas Department, in a Paper on "The Effect of the Fuel Crisis on a Medium Size Works" to the Wales and Monmouthshire Junior Gas Association, describe how the Ministry of Fuel and Power order to reduce coal consumption by 10% during the February-May quarter was complied with at Neath. Various methods were considered, but it was decided that the only effective thing to do was to utilize the flexibility of the carburetted water gas plant and the retort house to produce a richer gas from the former and a greater yield of lower quality gas per ton of coal carbonized from the latter. A balance in quantity and quality of both carburetted water gas and coal gas was set up, so as to maintain the mixed gas sent out at the declared calorific value of 425 B.Th.U. per cu.ft.

Industrial Gas at Stretford

Of the 34,694 consumers in the area of the Stretford and District Gas Board about 130 take 60% of the total gas output for use in industry. Although the industrial load has fallen below the wartime peak it is steadily developing on a peacetime basis. In a Paper on "Our Stake in Industrial Gas" to the Manchester and District Junior Gas Association T. H. Pardoe shows how this is being achieved and describes in detail the gas installations employed in a number of works. He emphasizes the necessity for specialized qualifications for the industrial gas engineer and the need for imagination in the structure of tariffs which, he suggests, would be more beneficial to the industry if based on trades rather than on consumptions. The very full discussion provoked by the Paper brings out some interesting points on the cost-price factor of industrial gas.

Thoughts on Steam

The days of cheap steam have gone, but power costs can be reduced to a figure more in proportion to the rise in the price of gas by better control and new methods of production and utilization. This, briefly, is the theme of a Paper by H. Buckley, Assistant Engineer and Manager of the Pontypool Gas and Water Company, entitled "Some Random Thoughts on Steam" to the Wales and Monmouthshire Junior Gas Association. The obvious ways of reducing costs are the maintenance of maximum efficiency from existing plant; full and efficient use of all possible waste heat from the setting; recovery of any other sources of waste heat available (e.g., sensible heat in coke, exhaust steam, oil of carburetted water gas plant, &c.); economy in the use of steam, cutting the steam usage per ton of coal carbonized to its absolute minimum; and the installation of more economical methods of steam utilization as opportunity occurs. The Author deals in detail with each of these desiderata and illustrates his conclusions with a series of nomograms.

STEAM HEATERS FOR PURIFICATION PLANT

The Gas-Works Safety Rules Committee of the Institution of Gas Engineers has considered the position in relation to Section 30 of the Factories Act, 1937, of steam heaters used to raise the temperature of gas prior to its admission to the purification process.

As there were various types of heaters in existence, many having been installed for a long period of years, from which, as far as can be ascertained, no danger has arisen in connexion with their use, and since even should an element burst no serious danger is likely to result, the Committee requested H.M. Chief Inspector of Factories to consider exemption in respect of such heaters under Exemption Order No. 19 (General).

The Institution has now been advised by H.M. Deputy Chief Inspector of Factories that heaters of this type may be regarded as " radiators" within the terms of Group 2(b) (Second Part) in Schedule One of Certificate of Exemption No. 19 (General).

WORKING PARTY VISITS

The Working Party of the Ministry of Fuel and Power, Fuel Efficiency Branch, visited the works of the Stalybridge Gas Department recently to secure information in connexion with coke dry cooling and to inspect the cooling chambers in operation. The Chairman of the Gas-works Committee, Alderman H. Riley, J.P., Mr. R. J. Restall, and Mr. W. R. Jessop (Deputy Engineer) entertained the party, which consisted of Dr. F. A. Williams and Mr. H. Bardgett (Fuel Research Station), Mr. F. R. W. Savage (British Iron and Steel Research Association), and Mr. G. B. Westcott (Ministry of Fuel and Power). Mr. J. H. Clegg (Oswaldtwistle) and Mr. J. B. Fleming (Marple) were also present.

The investigations being made under the auspices of the Ministry of Fuel and Power are embracing all phases of fuel efficiency, and visits to Stalybridge, Burnley, and Dagenham are the first official recognition that there may be a profitable saving to be obtained from dry cooled coke.

The Working Party are calling for the fullest information and were very pleased with the visit to Stalybridge and the opportunity of inspecting the coke dry cooling plant, which has been working successfully for 12 years.

PEAT FUEL

A Special Correspondent of the *Manchester Guardian* outlined in the issue of Wednesday last a proposal for the extended use of peat fuel made by Mr. J. W. Evans, proprietor of the engineering and paper-making works of Weston-Evans and Co., Clifton. It is estimated that Clifton Moss contains 12,000,000 tons of peat down to a depth of 12 ft., Mr. Evans has expressed his profound conviction that the country could be " saved " by the development of this and other peat fields.

He has designed—only on paper at present—a machine which would automatically cut and lift the peat and then, after compressing it between rollers and reducing the moisture content to some 40% deposit it in briquettes of the required size. It could then be air dried in a matter of a month or six weeks, so that its water content would be further reduced to 20%—or, better still, the dehydrating process might be considerably speeded up in drying sheds. Indeed, Mr. Evans sees little reason why the peat should not be ready for almost immediate use after being cut. Mr. Evans is convinced that peat could be produced more economically than coal, but even if the cost of extraction were twice as high as that of coal it would still be worth while, as it would amplify our resources, allow industry to continue running without interruption, and, if secured in sufficient quantities, allow a substantial amount of coal to be released for export.

The Government's attitude to the subject is referred to in the following extract from a letter received by Mr. Evans from Mr. P. D. Kirkman, Regional Fuel Engineer in the North-West : " The Ministry have stated their willingness to assist anybody who undertakes to produce peat in a marketable form, but only in the way of obtaining priority for supplies of material, labour, &c., and it would appear that up to date the matter is regarded as a private enterprise job."

To Bring Consumers to Gas Showrooms it becomes increasingly necessary to adopt as varied a type of demonstration as possible. For some years it has been the policy of the United Kingdom Gas Corporation to vary demonstrations by using personnel not of the Gas Industry and making use of the services that are offered by manufacturers of food products, &c., and with this in view it has recently carried out demonstrations on beauty culture, manicuring, and hairdressing. These demonstrations have been conducted throughout the Lancashire and Cheshire undertakings of the Corporation, and on each occasion they have attracted maximum audiences, so much so that the Corporation is contemplating making more use of this type of lecture. Although the demonstrations are in no way connected with the use of gas they are an interesting and attractive way of bringing people into the showrooms.

WATFORD AND ST. ALBANS CO-PARTNERS

There are now 658 members of the Watford and St. Albans Gas Company's Co-Partnership Scheme, 274 members of the 1928 pension fund, 342 members of the group life and pension scheme, and 74 members of the life assurance scheme. Allocations and transfers of stock to co-partners during the year ended Mar. 31 amounted to £3,940, and co-partners' voluntary deposits to the scheme totalled £4,408. The total amount standing to the credit of co-partners is now £23,700, and the stock owned by co-partners amounts to £34,400. A bonus of 4% on basic wages and salaries was declared for the year, and interest at 4% was paid by the Company on all amounts standing to the credit of members' accounts, representing a total of £8,000 bonus and £800 interest.

The accumulated pension fund exceeds £227,000, the Company having contributed £15,700 and members £5,200 during the year. There were 99 pensioners on Mar. 31, and pensions paid during the year amounted to £8,700.

Of all the employees, 37% are members of the Company's National Savings Group; £4,948 was invested during the year, making a total, since the inception of the scheme in 1940, of £38,313. Sums paid to hospital and nursing schemes during the year amounted to £350, in addition to which £50 was raised for charities.

PETROLEUM BOARD TO BE DISSOLVED

The Petroleum Board, a voluntary association of companies distributing oil in the United Kingdom, formed at the request of the Government in 1938 to ensure maintenance of oil supplies in this country, is to be dissolved on Dec. 31.

Control of prices and of imports must remain, and, at the instance of the Minister of Fuel and Power, two committees will be set up by the oil industry through which the Government will be able to obtain any information it may require and to secure the co-operation of the industry in making any arrangements needed to safeguard the national interest. One committee will deal with the supply, refining, and distribution of oil; the other with oil questions in general.

The Minister of Fuel and Power also proposes to set up a Consumers' Council to advise him on questions concerning the use of oil. As regards industrial relations, the oil companies have agreed to continue arrangements which have been established during the war to deal with questions arising in this field directly between the trade unions on the one hand, and, on the other, representatives of the employers as a whole.

The dissolution of the Petroleum Board will not, of course, affect petrol rationing.

PREVENTION OF STEAM LOSSES

There was a time—and it was not long ago—when steam leaks, provided they were not serious, were treated with tolerance, if not disregarded. The present coal crisis has put steam leakages in a somewhat different light and they are now a source of considerable financial loss not only to the undertaking, but also to the country. It is estimated that an escape through a ¼ in. hole at 150 lb. pressure would result in a loss of 415 lb. of steam per hour, and supposing a fuel price of 40s. per ton, an annual cost of £354. The most vulnerable points in steam piping are, of course, the joints and flanges where faults in packing cause a blow-out. A method of sealing these leaks swiftly and without the expense and inconvenience of shutting down plant has recently been brought to our notice. This is Furmanite, a semi-plastic solid prepared in cartridge form which, when heated above the temperature of boiling water, melts and can be squeezed by means of an injector gun into the smallest aperture. It also has the property of being subject to vulcanization under heat, forming a hard elastic and permanent packing. The method makes possible a metal to metal joint without having to polish the faces. It is necessary only to turn a shallow groove or grooves connecting with the bolt holes, bolt the two flanges together, and force the compound down one of the bolts. The compound therefore has not to take up any extra pressure when the pipes expand.

Furmanite is in use at many iron and steel works, sugar refineries, and at numerous other works and factories. A number of gas-works in the North are finding it valuable and recently Hendry Brothers (London), Ltd., who are acting as agents for Furmanite, arranged several demonstrations at Gas Light and Coke Company works. Following a demonstration at Beckton, the "JOURNAL" attended a demonstration at Nine Elms works where the advantages of this form of leak sealing were displayed.

To Meet the Need for larger premises the North British Rubber Company's depot in Birmingham has been moved from 159 to 161 Gt. Charles Street. The Company also announces the appointment of Mr. R. G. C. Lindsay as Mechanical Representative at Birmingham in succession to the late Mr. A. W. Pugh.

THE GAS INDUSTRY IN GERMANY 1945-1947*

RESTORATION AND CONTROL IN THE BRITISH ZONE

FOLLOWING is a report of the discussion on the Paper on "Restoration and Control of the Gas Industry in the British Zone of Germany, 1945-1947, which H. D. Greenwood presented at the Annual Meeting of the Institution of Gas Engineers in June (Communication No. 312). The Paper was published in the "JOURNAL" of July 23 and 30, and Aug. 6 and 13.

Mr. **C. A. Masterman**: I have listened to Mr. Greenwood's address with the greatest interest and much fellow feeling. It has been suggested you might care to hear something of the parallel problems in Austria where I was Controller of Fuel and Power.

In many ways the situation was similar to that in Germany. There were four zones in Austria, each separately administered by one of the four powers, Great Britain, United States, Russia, and France. Vienna, like Berlin, is an island in the Russian zone and is more or less jointly administered by the four powers. Nevertheless, there were significant differences between the two countries.

The population of the whole of Austria at about seven millions is a tenth that of Germany. Our Commision was consequently much smaller in size and was almost a family affair. As individuals we had to be jacks of all trades with much less chance of specialization. For instance, my responsibilities with a staff about equal to Mr. Greenwood's, included the following:

1. The mining, importation, and distribution of coal (practically all the Austrian mines are in the British zone).
2. Wood fuel (an important factor in Austrian fuel economy).
3. Oil (a tricky subject with all the wells and most of the refineries located in the Russian zone and mostly claimed by the Russians as German reparation assets).
4. Electricity generation, transmission, and supply (largely hydro electric and forming one of Austria's few exportable assets).
5. Gas and coke manufacture, distribution, and supply.
6. Water and sewage.
7. Housing (which meant chiefly first aid repairs and the production of building materials).

Due partly to the smaller size of the country we made more rapid progress in four power co-operation than in Germany. Our policy towards the Austrians was that they were perhaps more sinned against than sinners and that we could more rapidly delegate responsibility to an Austrian Government. In large degree that had been accomplished by last summer. Nevertheless, we had just the same difficulty as Mr. Greenwood in the wholesale losses of competent Austrian and German technicians and administrators under the de-Nazification rules. Finally, Austria is a much less industrialist country than the British zone of Germany. Austrian mines yield practically only lignite. All gas-making coal must be imported. About 90% of the gas production and consumption of the country is in Vienna.

The main body of the British Element of the Commission moved up into Vienna in August, 1945, about four months after the Germans had been driven out of the city by the Russians, who had been in sole occupation ever since. Thereafter our main task was to try to develop a common policy for all Austria in co-operation with our Allies.

That common policy was worked out at various levels. I led the British group in four power negotiations on Fuel and Power, sometimes involving several quandripartite meetings a week. Each of the four powers held the Chair for a month in turn and the periods of Chairmanship tended to be particularly hectic. From a fairly early stage we invited representatives of the Austrian Government to sit in with us as seemed appropriate. With four languages in use round the table (excluding American as a possible fifth) both co-operation and conflict were handicapped. While this was going on we were also taking over the administrative responsibilities and staff of Military Government.

Dislocated Economy

In view of suggestions that life in the Commission was a long glorious Bank Holiday let me say I don't think I have ever been more harassed in my life, though there was some let up later as the burden was shifted to Austrian shoulders. We knew our efforts really meant life or death for the Austrians around us. The job was anxious and arduous, but it was real.

We had moved up into a country whose economy was wholly dislocated, its buildings damaged, its communications disrupted, and its population demoralized. Especially in Vienna had hunger enfeebled the population and in the early stages they even were not strong enough to unload the food trains. I think, too, this may have been partly responsible for a mental inertia with which we were met. This was probably more pronounced in Austria than in Germany though the material damage to Austria was less extreme.

In a country so small as Austria the existence of zonal boundaries was particularly troublesome. Each of the four zones corresponded roughly in population to a large English county, each occupied by a different power and each more cut off from its neighbour than were neighbouring foreign countries in peacetime. Equally cut off was Vienna with a population about equal to that of the largest zone and containing the newly-constituted Central Government.

A minor incident will illustrate the zonal difficulties. The winding cable of the largest mine in Austria, in our zone, was damaged during the fighting. The main haul became dangerous, several galleries were out of operation and production was halved. I was able to get wire from our zone, but the only twisting machines were in the Russian zone. It took four months to get a permit from the Russians for the work to be done and involved reference to Commander-in-Chief level. When received the permit was out of date and had to be renewed. Finally the wire was sent through, with an appropriate quota of coal, but material for the soft core was lacking. This was obtained only by untwisting the old cable. After other adventures the complete cable was transported back months later on two road transporters travelling together with the slack sagging between. And that was just one minor job. I would not have you conclude the Russians were merely being gratuitously difficult. It might as easily have been one of our other Allies. In this particular case, due to zoning, the Russians would get none of the additional coal which they badly wanted. And why—because we wanted them to release to our zone some of the oil from the wells in the Russian zone. Also they wanted horseshoes from a factory in our zone which we could have released only at the expense of wire nails badly wanted for house repairs and D.P. camps in our zone. Whichever zones might be concerned exchanges could only be made by barter and every bargain involved complications. In my experience the Russians were tough but dependable. They took pride in living up to their undertakings and when they failed I think it was due to incompetence at the administrative level rather than by intent. Language, too, was a real trouble.

Difficulties in the Wider Field

At every turn incidents of this kind, which in normal times would present no difficulty, would hold up reconstruction. There was similar difficulty in the wider field. Austria had been part of Germany for seven years and prior to that was largely dependent on Germany for engineering equipment. Some of the gas-works plant had been in course of erection by German contractors. Completion was urgent but Austria had virtually no assets with which to pay and in any case the theory was that all payments to Germany had to be made in U.S. dollars. And of course there were no dollars. On one occasion having located an important piece of plant for Austria lying in Berlin I sent a squad with a British transporter direct to Berlin, and with passes largely invalid, and by means I hesitate to describe, they came back with the load.

But such successes were rare. Repeated losses of empty wagons returned to the Ruhr for coal, about 800 mile haul, were diminished only by the extreme expedient of armed guards, and the partial loading of the wagons with pit props which Austria could ill spare, but which were needed in the Ruhr.

I give the Austrian miners full marks for their efforts, but last summer they faced the prospect of no clothing or boot replacements for the winter. The stuff just wasn't being made in Austria, but coal production would clearly depend on it. One of my staff was active in the matter when I left, and knowing him I felt confident he would succeed provided he had a free hand.

At this stage I would pay tribute to the British Army authorities in Austria. At the outset there were naturally many misunderstandings between the military and the civilians on the Commission. But this changed and we were soon working together

closely and happily. Without their help, official and unofficial, we could not have got by. Austria owes much to British troops.

I have said the Gas Industry in Austria is largely confined to Vienna. Some of you know the two very fine works there, one at Simmering, in the British sector, and the other across the Danube, in the Russian zone. Both had been damaged, but both were partly operable. The chief difficulty, after repair of the mains, was in providing gas-making coal. All had to come from outside Austria. Up to the time I left nearly all came from the Ruhr, though after great efforts a small quantity was then beginning to come through from Poland. From 15,000 tons in July, 1945, the monthly deliveries of Ruhr coal to Austria rose to about 150,000 during 1946.

We interfered as little as possible with the technicians of the gas undertakings on the grounds they knew their job a great deal better than we did. It was our effort which brought them the coal. It was for them to make the best use of it. Normally they produced a high proportion of coke, by British standards, and little or no C.W.G. This situation was modified by the piping into Vienna gas-works of natural gas from the oil fields which enabled C.V. of the manufactured gas to be reduced at the expense of the coke yield. But, before I left, the natural gas supply for gas-works use was diminishing for various reasons, including its developing use as bottled gas for motor vehicles. (The petrol yield from Austrian crude oil is very low.)

Gas-making in Vienna

In normal times the gas consumption per head in Vienna was nearly equal to the level familiar in Great Britain. The annual coal throughput of the works was about 600,000 tons. We were unable to allow coal for even half this rate of consumption. (I envy Mr. Greenwood his coal allocation in Germany which enabled him to restore consumption to the full 1935 level—a further confirmation to me that the needs of Austria, a lesser enemy, tended to be disregarded.) Hence it was necessary to restrict gas severely, but the enforcement of the rationing was almost impossible and the effective control was by limiting the periods of pressure to a few hours daily. As in Germany broken mains and other causes led to high rates of leakage and to some casualties, but the Viennese welcomed the increasing restoration of gas supply at the price.

In addition to the Vienna gas undertaking I should perhaps also mention the Hermann Goering plant at Linz, in the American zone. Last summer we were planning a coal allocation for this plant to enable it to come into limited operation for the production of metallurgical coke, gas, and fertilizer. It is a vast works, badly damaged by bombing, designed to give a balanced production for war purposes, and its peacetime future had become a vexed question.

Throughout my time in Vienna I was particularly struck with the general acceptance of the fact that where coal supply was most exiguous it gave best value to the community if processed through the gas-works. There was general agreement that the gas undertaking had virtually first call on suitable coal. Direct domestic use of coal was nearly non-existent; thermo electric plants used oil residues or lignite dust. Lignite was the chief industrial fuel.

I cannot close without making two observations. First I wish to congratulate Mr. Greenwood on his Paper, which modestly does less than justice to the fine work he and his colleagues were doing in Germany and of which I saw something on my visits. Secondly, I would ask you in a wider sense not to lose interest in Austria which, though it is small, is the country furthest east in Europe in which the four Allies and a late enemy find themselves obliged to co-operate on more or less equal terms. It was often evident there were fundamental differences of approach, but circumstances forced compromise and agreement. As time went on suspicions tended to diminish and mutual confidence to increase. It may well be a slow process, but Austria, for all it presents of causes for dispute, may have made and may still make important contribution towards international understanding. If it be so then our four power agreements over gas-works operation in Vienna may have been straws towards a harvest of international tolerance and constructive effort.

"A Marvellous Job of Work"

Mr. **R. Kelf-Cohen** (Director, Gas and Electricity Division, Ministry of Fuel and Power): I am very grateful, as a mere official, for the opportunity to make a few remarks on Mr. Greenwood's Paper. I would like to begin by endorsing what Mr. Masterman has said about the extreme modesty of the Paper, because it is quite clear from the tremendous mass of detail so clearly set out that Mr. Greenwood and his staff have done a marvellous job of work. I cannot, of course, pretend to the experience which you gentlemen have in facing difficulties due to the war, but when, for instance, one is told in the Paper that when they started the percentage of unaccounted-for gas was 70%, and that they got it down to 20%, a mere statement like that conveys an impression of a tremendous achievement in a short time, because it is only two years since V Day and, on Jan. 1, 1947, we handed over to the Germans the administration. Looking through the Paper my impression is that they seem to have had our difficulties, but ten times worse. There was a shortage of labour, shortage of technical skill, shortage of material, and a terrific amount of repairs to damage all over the place. Then as regards allocations of materials, when one is told that the time allocated was only 2½% of the requirements, you get some idea of the difficulties, and the manner in which Mr. Greenwood and his staff coped with them.

Of course, they have a very peculiar problem in the British zone because they are dealing with a most highly industrialized section of Germany which, so far as gas is concerned, was dominated by the one large unit of Ruhr gas which alone, according to the figures in the Paper, supplied over 100,000 million cu.ft. of gas a year in normal times.

Finally, I should like to make a few comments on rationing. I was interested in what both Mr. Greenwood and Mr. Masterman said with regard to this. There have been innumerable discussions in regard to the rationing or restriction in the domestic consumption of gas—and also electricity, for that matter—and during the years I have been associated with the Ministry of Fuel and Power, I have always felt that the rationing of these two fuels presents the greatest problem in administration that can be envisaged. The rationing of food is not to be compared with the difficulties in the rationing of gas and electricity. I remember a statement by Sir William Beveridge in 1942 when the subject was under discussion. He put it very simply. He said that the rationing of food is very easy, but the rationing of gas and electricity is very difficult because, after all, the human stomach does not vary very much from person to person, but fuel requirements vary almost infinitely.

I was particularly interested in this matter because both Mr. Greenwood and Mr. Masterman agree that the rationing of gas and electricity can only work if you have really brute force in the background. I think it is the threat of physical disconnexion of supply that makes the domestic consumer play the game, though I must confess that having read the Paper I am not quite sure how the domestic consumer in Germany really does play the game, because many of them seem to be in the happy position of having no meters or anything with which to register any gas at all! However, I suppose the amount of gas that goes out is carefully controlled and that that, in the end, produces the rationing. Physical disconnexion, in the last resort, is probably the best means of obtaining rationing and you can apply that when you are administering a conquered country. And this makes me feel that the problem of rationing gas and electricity in our own country is one of insuperable difficulty.

Use of Coke Oven Gas

Mr. **W. Hodkinson**: Mr. Greenwood's Paper presents to us the record of a gigantic task undertaken by a small team of enthusiasts and determined British gas engineers of whom we, as brother engineers, have every reason to be proud. I was fortunate to be a member of the B.I.O.S. Party, led by Dr. Braunholtz, on an extended tour of inspection in Germany in July of last year, and two features remain vividly in my memory—viz., the awful chaos and destruction throughout the land and, by contrast, the cheerful optimism of the members of Mr. Greenwood's team in tackling what, even at that late date, appeared to be the impossible.

As Mr. Greenwood points out in his Paper, the most interesting feature of gas supply in the British zone is the extensive use of coke oven gas, and the development of bulk distribution over very wide areas at high pressures. A detailed consideration of this feature will, I believe, form the major part of the B.I.O.S. Report, yet to be completed and which Mr. Greenwood refers to.

However, I believe at this juncture it would be safe to say that the Germans are unable to add to our knowledge on the subject of bulk distribution technique or economics, and, indeed, in many respects they are behind us. I may add that the investigation now under way will probably prove conclusively that a single grid of the magnitude of that now operating in

Germany would be quite impossible in this country, as an economic scheme.

With regard to the "Grid," one interesting point emerges from the Paper, and it was a point on which I sought to gain the fullest information during the tour: How did the "Grid" system generally fare under the rigorous test of intensive bombing; what was the speed of repair; what special precautions, if any, were taken to guard against serious damage to life and property from a "Grid" operating at high pressures following damage arising from bombing? Generally, I believe it can be stated that the system has stood up to the test amazingly well, and the speed at which it has been restored to work, as shown in Mr. Greenwood's paper is, to my mind, some indication on this point.

The organization of the German Industry under the Nazi regime, following upon their accession to power in 1933 and the passing of the Energy Laws in 1935, gave the Government very wide powers of control and, in many ways, the doubtful advantages gained are, as Mr. Greenwood points out, very similar to those claimed by the exponents of nationalization in this country. One therefore might ask what happened to the Industry during that period from 1933 to 1945? From my own observations I would say that to all intents and purposes development stood still and certainly in the case of the German gas-works and coke oven plants that I inspected there was little sign of any attempt at modernization or the utilization of many of the modern developments now common to the Industry in this country. I myself gained the impression that the German Industry has, for some years, suffered the dictates of those who, unfortunately, are even now appearing in our own midst—the economic dreamer and the amateur gas executive culled from any profession but that with which we are concerned.

Mr. **R. W. Crowther**: As a member of a B.I.O.S. team to visit Germany last year, and having spent some considerable time in Germany before the war, I can, from first-hand knowledge, tell you (and I use the Author's own words) that conditions in Germany, particularly in the Ruhr and in Berlin, are "*very inadequately described*" in this Paper. One has to *see* to appreciate properly the most dreadful and deplorable conditions existing there to-day. I should like to take this opportunity of congratulating the Author on his achievements, and, if I may add a personal note, for the care given to the arrangements for our B.I.O.S. visit last year. In the most difficult circumstances we received most kindly attention from all making our visit as pleasant as it was possible to be.

Reference is made to the fact that the static form of carbonizing plant is most popular in Germany, but I should like to ask the Author if he would agree that a very important reason for this is not only the class of coal available but the quantity and quality or nature of the coke produced, raw coal not being used as extensively in Germany for domestic heating as in this country. Again, reference is made to mechanical producers. In the larger installations there is no doubt that central mechanical producers were extremely popular in Germany and there are indications that we are following the same trend here to-day, due no doubt to the labour problem, and despite the fact that costs are greater and in general there is a loss in thermal efficiency. I have, however, seen an excellent example of a "built in" mechanical grate which might well be borne in mind, particularly for existing carbonizing plant which does not lend itself to separate producers. Will the Author give us the benefit of his more extensive knowledge of the German Gas Industry in this respect, particularly as regards the smaller and medium-sized plants.

The conversion of horizontal retorts to horizontal chambers is referred to in the Paper. I should be glad to know if the Author has any additional information on this subject, which lends itself to application in this country, particularly at present with the difficulty of obtaining entirely new plants. I have seen several excellent examples of such conversions in Germany resulting in increases in output of upwards of 50%.

I agree with the Author in reference to German stoking machinery for horizontal retorts; they do not bear any comparison with the modern machine in use here to-day. I think "primitive" is the correct description of the German designs I have seen.

A Herculean Task

Mr. **J. W. Pallister**: I would like to congratulate Mr. Greenwood, not only on his interesting and informative Paper, but also, and particularly, on the excellent job he has been carrying out during the past two years in control of the Gas Industry in the British Zone in Germany under such extraordinarily difficult conditions as he has described. With the German Administration completely broken down, broken gas mains under literally millions of tons of rubble, unaccounted-for gas as high as 70%, and gasholders completely destroyed, his task would have been a Herculean one under the best of conditions. But in addition to the task of restoring a whole Industry which was out of action, he was faced with a desperate shortage of every type of material—coal, refractories, steel, and cast iron. I was fortunate in having the opportunity a year ago of paying a visit to Germany, during which Mr. Greenwood conducted us on a very extensive tour, and I can therefore speak with a full appreciation of the magnitude of his task and the work which he has done.

With regard to gas plant generally in Germany, I formed the opinion that we have little to learn from the German Gas Industry. Indeed, by British standards the plant was largely out of date. In arriving at this conclusion full allowance was made for the damage sustained by allied bombing and artillery, and for the dilapidated state of the works through lack of maintenance.

The outstanding feature of the tour was the opportunity afforded for the inspection of the German Gas Grid, this being the aspect offering the most marked difference, by its magnitude, from British practice—*i.e.*, the transmission of much larger volumes of gas (159,000 million cu.ft. in the year 1943), over much greater distances (1,800 miles of grid mains), and at considerably higher pressures (120 to 530 lb./sq.in.), than any existing Gas Grid in the United Kingdom. Conditions in Germany were, of course, much more favourable for the development of a Grid on such a scale due to the very large concentration of coke oven plants in the Ruhr, with the immediate proximity to large quantities of cheap easily-won coal.

Mr. Greenwood has referred to the elaborate control system of the Grid. This was a highly developed system of cables laid in the trench alongside pipelines and operating long-distance pressure and volume indicators and recorders over distances up to 160 miles, and also providing telephone communication by means of portable telephones which could be plugged in at points about 1¼ miles apart along the route of the mains.

A striking feature of the high pressures used in the long distance transmission was the storage capacity of the grid mains, equal to 10% of the daily load, a valuable factor in controlling the variation of supply and demand of which full use was made after so many gasholders were put out of action.

Mr. Greenwood has referred to an underground high-pressure gasholder which is situated near the southern extremity of the grid line near Frankfurt-am-Main, and which we had an opportunity of inspecting. This was a novel example of the high pressure gasholder and consisted of 36 steel pipes laid close together underground, each 25 in. inside diameter by 1,625 ft. long (nearly one-third of a mile). The storage capacity was six million cu.ft. of gas under a pressure of 530 lb./sq.in. My only criticism of the Paper is in the adherence throughout to the metric system and the absence of the equivalent British measurements. While Mr. Greenwood has perforce to think and work in metric measures in Germany, these figures do not convey their values at a glance to a British audience.

TAR SURFACE DRESSINGS

During the war the Road Research Laboratory of the D.S.I.R. issued a series of Wartime Road Notes dealing with matters of current practical interest to road engineers. The wartime series has now been discontinued but in view of the welcome given to it, a new series of Road Notes has been started, which will similarly present those findings of research and experience that are of immediate interest to practising engineers. The Road Note series is complementary to the existing series of Road Research Technical Papers, which describe particular research activities in somewhat greater detail.

The first of the new series—Road Note No. 1, "Recommendations for Tar Surface Dressings"—is now available (H.M. Stationery Office, 3d., by post 4d.). It is a re-issue of Wartime Road Note No. 8 which has been out of print for some time. The Note has been brought up to date and certain recommendations referring to special wartime requirements have been omitted. It describes methods of applying surface dressings on waterbound macadam, concrete, and on wood block paving as well as on the normal bituminous surfacings.

Experience has shown that, on an old bituminous road surface, a surface dressing composed of suitable materials correctly applied can be expected to have a useful life of at least three years and often longer. There are in fact many examples of roads, surface dressed before the war, that are still giving useful service, and it is not unreasonable to assume that under favourable conditions a well-laid dressing will have a life of at least five years.

THE HIGH-PRESSURE GASHOLDER

FOLLOWING is a report of the discussion on the Paper on "The High-Pressure Gasholder" by M. Noone (Chief Engineer) and A. G. Grant, M.Sc., Assoc.M.Inst.Gas E., M.I.Chem.E. (Director and General Manager), Whessoe, Ltd., at the Annual Meeting of the Institution of Gas Engineers in June (Communication No. 314). The Paper was published in the "JOURNAL" of Aug. 13 (pp. 364-366) and Aug. 20 (pp. 411-423).

MR. **F. M. Birks** (Deputy-Governor, Gas Light and Coke Company): The Paper has obviously been written, as the Authors frankly say, to get a lead from the Industry as to what it requires, and it also gives a lead as to the Authors' views. For example, the first conclusion in Section XII of the Paper says: "It is in the best interests of the Gas Industry that no considerations of first cost, storage economics, or local circumstances should be allowed to obscure the necessity for the highest standards in design and construction. To this end it is desirable that there should be close collaboration between gas engineers, designers, and insurance companies in the drawing up of codes and specifications, particularly during the development period." It was my very good fortune for a number of years to be associated with the late Mr. Hardie, and during the whole of the time I knew him and worked with him I never heard him once suggest that any consideration of first cost should be taken into account in deciding what should be done, but that the highest standard should always be obtained. No other consideration was ever taken into account. I may also say that my training has been such that I would always endorse that policy.

With regard to the hydraulic test, I remember a specification for one of the earliest high pressure holders in which the hydraulic test was included as a natural part of it, but we found there were great difficulties in carrying it out. I regret to say that since then we have allowed the air pressure test for holders of this particular type but, in future, any new holders will be subjected to the hydraulic test. I am now beginning to wonder whether we are right in dealing with these very large flabby structures in the way we have and that if a holder or any other structure, for that matter, is to be a first class engineering job, all the material in the structure should be at the maximum stress.

A Pretty Piece of Engineering

The solution of the internal ring put forward by the Authors is a pretty piece of engineering and probably gets over the trouble they visualize, but I hesitate to think it is original. It was a feature of the design of the ill-fated rigid Airship R 34 and I think for practically the same reason—viz., redundancy of material, which is a real problem. I wonder if the Authors can tell me what is the difference between the weight of this redundant material and that which would be necessary in making smaller holders which, in themselves, would be sufficiently stiff and able to take any incidental stresses or secondary stresses necessary for the hydraulic test or when the holder was not loaded. I venture to suggest that the difference in material is not very great, if any. Last year I suggested that we should consider the building of a smaller holder, shop-made, and delivered in one piece on site. I believe the Author's firm are building one at the moment for an undertaking in which I am interested. Perhaps the Authors will let us know if the weight of the material is greater than having a single vessel. So far as I have been able to see, there is no difference.

The largest container of which I have had experience was built in the shop and delivered on site in one piece. It was a steam accumulator 11 ft. 6 in. diameter and 66 ft. long. It was brought by road from Scotland to East London. It was perfectly stiff and required no secondary stiffening structure at all, and it has been in satisfactory service for a number of years.

The question of the pressure to which these storage holders should be taken is an important one, but I think we could go rather higher than I have gone at present. However, that is a question of economics and I would like to suggest that if at any time any of the contracting firms who are building these holders would care to get into touch with me, I would be very pleased to collaborate with them in finding out what is the most desirable relationship between pressure, diameter and volume to ensure that these holders can be made without any additional reduction of material.

I very much appreciate that the Authors have written this Paper with a very high degree of what I call technical integrity, and I should like to thank them very much indeed for bringing this subject forward.

Birmingham's High-Pressure Holder

Mr. **R. G. Marsh**: My contribution to the discussion on the Paper will be more in the nature of a corollary to that Paper with special reference to the half-million high pressure holder which is now approaching completion on our district. When the order for this holder was placed there was very little question in my mind as to the relative merits of riveted or welded construction, and I was definitely in favour of riveted. Since that time a great deal of discussion has taken place and I have gained considerable further knowledge of the merits of the welded construction under conditions of proper supervision and X-ray examination, so that now I am not by any means convinced that riveted construction is to be preferred to welded. Circumstances altogether outside our control are entering into the question and it would appear that a choice between the two methods of construction is no longer possible and that holders of welded construction will, of necessity, be supplied in all future installations. This is purely on account of the difficulty in obtaining the requisite class of labour suitable for this heavy hand riveting work. The trade appears to be dying out owing to the laborious nature of the work, and no young men, or at least not in any quantity, are coming forward to replace the older generation who took a pride in the excellency of their craftsmanship; in fact, we have been definitely told by Whessoe, Ltd., that they cannot undertake the construction of another riveted gasholder owing to this labour difficulty, and if these conditions apply to this firm, I have no doubt they will apply equally to other makers.

Further investigation of methods of welding and conditions under which the work is carried out, and tests to be applied to the completed welds, have therefore been occupying our attention with a view to the recommendations I have to make in connexion with the extension of the present installation at Longbridge. It is becoming obvious that extensions to this plant, even before the completion of the first stage, are necessary, and a decision on this matter has to be arrived at at a very early date, and the work, which will occupy some considerable time, put in hand at the earliest possible moment.

Concerning now the work in connexion with the present holder: it was my hope at the commencement of this job in October, 1945, that it would have been completed and in operation by February of this year, but the labour difficulties with riveting, already referred to, were such that delay was experienced. Then again we had a spell of appalling weather in the early part of this year which seriously hampered operations, with the net result that riveting was not completed and the holder ready for filling with water until the latter part of March of this year.

At this point, however, I would like to pay tribute to the personnel of the staff of Whessoe, Ltd., who did everything possible to expedite the work under such conditions of severe handicap, and particularly to the manual staff on the actual job who stuck to it with most commendable perseverance during the severe weather conditions to which I have referred.

The Question of Testing

In the early days a considerable amount of thought had been given to the question of testing the holder on completion of riveting work, and at one time it was decided that this test should be by means of air pressure. The risks attending this method of testing, however, were considered to be so great that it was abandoned in favour of a hydraulic test, and I think this decision was perfectly sound and in accordance with accepted engineering principles. This did mean, however, that considerable modification had to be made to the design of the concrete foundations, which had to stand the very much increased load upon them due to the weight of water—in the case under review an additional load of about 3,000 tons. These modifications were made, and I think the extra expense involved was fully justified.

We were fortunate in having extremely good sub-soil on which to build these foundations, and they were designed so that the load on them under the test conditions, would be 2 tons per sq.ft., and this was considered perfectly safe in view of the nature of the sandstone formation.

As so much importance attached to the stability of the concrete foundations, special arrangements were made to observe whether or not any settlement or sinking took place under the application of the load, and to this end sighting bars were affixed to each side of the 13 bases, and these were marked up and arranged in such a position that all those on one side could be observed together through a levelling instrument set up at a suitable distance away from one end of the holder. One sighting bar was placed on the foundation plate and another one on the cradle so that any variation of these individual members as well as subsidence, if any, of the whole of the foundation, could be observed. I am pleased to be able to state that throughout the whole period of filling, caulking, and emptying, no movement beyond the settling by about $\frac{1}{8}$ in. occurred on any of the concrete plinths; thus any trace of anxiety which existed before filling commenced, as to the stability of the structure, has been completely removed.

The operation of filling the holder with water took three days, and in this we had the assistance of the N.F.S., who provided the necessary pumping apparatus and drew the water from a stream about 400 yds. away from the site of the holder, and discharged

it through the manholes at the top, into the interior. Pumping operations were continuous day and night until the holder was filled. Caulking operations then started and a good deal of work was necessary before the holder was in a condition to have any additional pressure applied to the water content. During this period the holder was kept full, and leakages were made up by the addition of water from the town supply through a ¾-in. pipe.

On April 17 the holder was sound under static conditions of pressure. The manhole covers were then put on and the hydraulic pump was started and internal pressure increased. The caulking work continued as the pressure gradually rose and leaks appeared, but it was not until May 20 that the whole structure was sound at an applied pressure of 100 lb. per sq.in. On this date the official inspection was made by representatives of the Insurance Company as well as the makers, and the holder passed as satisfactory.

Water Capacity Under Pressure

The process of emptying the holder of water commenced on May 22. Before the emptying started, however, I thought it desirable to ascertain the quantity of water which would be expelled from the holder before the test pressure of 100 lb. was reduced to static pressure of 11½ lb. at the base of the holder. In other words, how much water it would be necessary to add to the contents of the holder already standing completely full before the pressure was raised to 100 lb. per sq.in. Various estimates of this quantity had been made by ourselves and other interested parties, and these varied from 100 to 300 gallons.

I note that the Authors of the Paper state that in a holder of this size the volume will increase by 66 cu.ft. between zero and 75 lb. per sq.in. That represents a quantity of 412 gallons. In actual fact all these estimates were wrong and the quantity of water discharged from the holder until the pressure fell from 100 lb. per sq.in. on the gauge on the base of the holder to 11½ lb., representing the static head, was no less than 815 gallons.

It is obvious that the shell of the holder had not been extended to such an extent as was necessary to accommodate this quantity of water, and some other explanation must be forthcoming as to this amazing result. A suggested explanation is that in the process of filling a considerable quantity of air had been trapped in the complicated interior girder work and this air was compressed to a much smaller volume under the conditions of test and re-expanded when the pressure was removed, or, due to bacteriological effects, gases may have generated in the interior of the holder during the period when it was full of water. There is no doubt, however, that the holder was completely full after the expulsion from it of 815 gallons, because when the lids of the manholes were taken off, the water was up to the top of the manhole.

On May 22 the process of emptving the holder was started, and under gravity conditions only the rate of emptying was rather slow. To accelerate it the manhole lids were replaced and air pressure applied up to 50 lb. per sq.in. The emptying occupied five days and the holder was then opened and cleaned out. At the moment, when the last of the water was expelled from the holder, there was an air pressure inside of about 40 lb. per sq.in., and considerable care was taken in allowing this air to escape. This was done through an open 3 in. pipe, and it is rather striking to note that under these conditions it took a considerable time for this excess air to disperse, and it brought home to me the wisdom of first applying a hydraulic instead of a pneumatic test to the completed holder, owing to the enormous amount of stored up energy which exists in gas under pressure in a holder of these dimensions. If any rupture were to occur under conditions of test when air is being used the results might be disastrous.

Experience in Switzerland

Colonel **Zollikofer** (Switzerland): I should like to say a few words concerning experiments made in Switzerland with high-pressure gasholders. In 1928 a suggestion was made in the first number of our Monthly Bulletin to construct high pressure gasholders and to utilize all the advantages they can give. In the same year three plants were started and in 1929 there were in service one gas-holder in a gas-works itself and seven gasholders in distant high pressure stations of two gas-works. The rapid development of high pressure gasholders was easy at that time when the modern technique had made possible the welding of holders, the construction of rotary compressing machines, the construction of a great many electric automatic instruments and switches, and, last but not least, good high pressure governors for gas.

In Switzerland the gas-works appreciated the following advantages of high pressure gasholders:

Gas reserve available at high pressure for peak load; gas reserve available distant of the gas-works, at high pressure for feeding a low-pressure; high pressure gasholders are loaded with low gasified current during night time; cheap foundations; low maintenance cost; no heating; use of gas supply at long distance; high pressure gasholders can and were being used for gas oil tanks; when out of service, high pressure gasholders can be used for many other purposes; landscapes not spoiled.

These advantages may be the reason why in 1929 three of the 75 gas-works in Switzerland had high pressure gasholders. In 1936 no fewer than 28 gas-works had 54 high pressure gasholders; 20 gas-works used 28 gasholders on the gas-works plant, and 10 gas-works had high pressure gasholders at distant stations.

In 1946 more than half of the gas-works in Switzerland had high pressure gasholders; 77 gasholders were placed as follows: 38 holders at gas-works and 39 holders at distant automatic stations. The lowest pressure used was four atmospheres—*i.e.*, 56 lb./sq. in.—and the highest 10 atmospheres (some 142 lb./sq.in.). These holders have 8,010 cu.m. capacity when empty and 53,530 cu.m. loaded. Medium pressure is six-seven atmospheres. The distant stations are automatically controlled and do not need the presence of personnel.

The details given in the Paper are of great interest to me, as I was delighted to hear that the same principles have been adopted here as in Switzerland, concerning safety. What has been said concerning testing is excellent. As our high pressure gasholders are all welded, hydraulic testing was necessary.

The Inspectorat Technique des Usines à Gaz Suisses collaborates therefore with the Sté. Suisse des Propriétaires de Chaudières à Vapeur. When hydraulic test was adopted, the construction of spherical high-pressure gasholders was practically excluded. The water test is made after construction: in the factory when the holder is completely constructed there, or on the site where such construction is necessary.

In general we normally use factory-made holders. When exceptions were to be made, factory-made rings with bottoms were transported to the site. With regard to railway and tunnel clearances, the maximum diameter has been, until now, 3.15 m.—*i.e.*, about 10 ft. The gas-works prefer a battery of high pressure gasholders to one big holder because of the quality of work, the possibility of control, the question of gas reserve, the development of the stations, one by one, and ease in putting into or out of operation one or more high pressure gasholders.

I should not like to waste your time by going into further details. It may only be mentioned that our first high-pressure gasholders were placed on five supports. All the newer stations work with two supports only. For gasholders of the size I described this is sufficient for the empty or gas-filled holder. For hydraulic test the high-pressure gasholder is temporarily supported by wooden blocks. In general, such a test is made on new holders only and may be perhaps never more necessary. In order to protect the holder against external corrosion the high-pressure gasholder must be provided with sheets fixed at the holder walls above the supports; thus no water will enter between the supports and the holder. Steam-boiler manholes having shown difficulties in service by gas losses, screwed round covers have been required now. Our practice is to set weight loaded safety valves.

Internal corrosion is avoided, when dry gas and gas with traces only of sulphur is available. The only effective protection seems to be internal painting with Portland cement and water (we call it cement milk). Any further information on experiences made will be given with pleasure.

The Insurance Factor

Mr. **A. H. Goodyer** (National Boiler and General Insurance Company): Apart from the ordinary principles of mechanical design there are a number of other factors in this problem which are more important and not quite so obvious. There are, for instance, the so-called brittle fractures on large welded structures and these are probably materially affected by the relation between the carbon and manganese, which produces a drop in the ductile and brittle transition point under impact or shock loading. A good deal of work has recently been done by Barr at the Cambridge Engineering Research Department on that subject. Consideration has been given to such matters as the residual stresses which are built up in a structure which is completely welded into a form like a sphere or a cylinder. Fractures so caused have a material effect on the transformation from the ductile to the brittle and upon the locked-up or residual stresses. There are also certain other things that can produce a brittle fracture such as notches which we found when the welds were not properly supervised. The effect of a notch on an unsuitable material with an internal stress in the plate material plus an additional load from an expansible gas inside, can lead to failure, and it is considerations of this kind which must be taken into account primarily in the design of a welded gasholder.

A great deal of work has been carried out all over the world in connexion with welded ships bridges—fortunately only a few welded gasholders have failed in this country—and in this country this research work has been done by the Admiralty, the British Shipbuilding Research Association, the Cambridge Research Department, and the British Iron and Steel Research Association, but it is quite certain that the last word has not yet been said on this problem. A very careful consideration of all the factors involved is still required. They involve the manufacture of these structures, the use of suitable material, design, workmanship, &c., and it is all these things that have led the A.O.T.C. to consider the problem of the design of welded gasholders for high pressures

in order to see that they are an insurable and safe proposition. The one test which is likely to be the most controversial is the hydraulic test. In America, opinion seems to be divided, but they have abandoned one test—viz., the hammer test—for the reason, apparently, that they find the hammer test itself starts a failure of a brittle nature in a welded holder which has the characteristic of unsuitable material internally or tri-axially stressed notches. There seems to be a dangerous condition set up by hammer testing during hydraulic testing, but personally I should hammer test lightly, without indenting, during the hydraulic test.

I think the Industry is fortunate in having a firm like the Whessoe Company which is prepared to study the matter scientifically, and I know that the work which Mr. Noone himself has done is only sketchily set out in the Paper. I must say I congratulate him on his approach. I think he is in the forefront of welding engineers.

The Case for Riveted Construction

Mr. S. M. Milbourne: I should like to take this opportunity of congratulating the Authors on the production of a most interesting and instructive communication which should appeal to all engineers concerned with the heavy engineering side of the Gas Industry and to manufacturers of gas-works plant in particular. It is most gratifying to find that riveted as well as welded high pressure gasholders have been dealt with and that both forms of construction have been fairly commented on. The various features in design which require special attention are set out in such a manner that the relative advantages of each form of construction, as well as their disadvantages, can be properly assessed. The great care that must be taken in the construction of welded vessels and the Authors' statement that X-ray photographs will become general and perhaps obligatory in the near future, as well as their suggestion that "treepanning" or "probing" should be carried out on the welded seams for the purpose of testing, will go some way towards inspiring more confidence in welded high pressure gasholders. In time, some means may be found of relieving the residual stresses which are set up on site work when the weld metal cools, but until this is possible, I still feel that many prudent engineers will prefer to go in for riveted high pressure holders. It will be observed that the largest high pressure holder of recent design to be erected in this country is riveted, and as other large riveted vessels are already in process of manufacture, I am wondering whether the Authors are not somewhat premature in referring to the "decline" in riveting, at any rate so far as the construction of high pressure holders in this country is concerned.

Extra Expense

With regard to pressure testing, I am in agreement with the Authors' suggestion that these vessels should be hydraulically tested and particularly if they are of welded construction, but this entails appreciable extra expense, as stated by the Authors. The argument that American engineers have built larger high pressure holders than any we have in this country and that these have not been hydraulically tested will do much to divide opinion as to what is and what is not necessary in regard to the final test on completion of these structures.

The method of supporting large high pressure holders is very important, and I should like to know whether the Authors favour cradle supports such as are described in Appendix 3, or saddle supports arranged at intervals on each side of the vessel. Whichever type of support is used, both lateral and longitudinal movement should, I think, be provided to ensure that the container is free to expand or contract in any direction.

In Appendix 3 a description is given of the ball races on which the container is mounted, but it is not quite clear whether the ball races are arranged immediately beneath the cylindrical vessel or beneath the bases of the cradles and the concrete foundation blocks. If the ball races are arranged radially on the outside of the container, this would enable the vessel to be revolved during its erection, but no free lateral movement of any portion of the cylinder can take place when the gasholder is in commission. The action of strong sunlight on one side of a long container might be expected to give a slight camber to the vessel due to the unequal expansion of the shell plating, and perhaps Mr. Noone would let us know whether he considers provision should be made for slight lateral movement under such conditions.

Latest American Design

In connexion with this matter, I would like to refer to one of the latest American designs of support for high pressure cylindrical holders. The vessel is supported on two large external ring girders, positioned at about one-quarter the length of the container from each end. Each ring girder is attached to two sets of links on either side of the vessel and these links are in turn secured to steel uprights firmly bedded at their lower end to the top of the foundation blocks at ground level. This design provides for the whole of the weight of the structure being brought on to four supporting points only, and has the advantage that slight movement of the container in any horizontal or even vertical direction, can take place without restriction. The four high pressure holders at Long Beach, U.S.A., each of 500,000 cu.ft. capacity, were supported on this principle. These vessels were not subjected to hydraulic tests, but this design of support appears to be well worthy of consideration by engineers in this country.

I have not checked over any of the formulæ which appear in Appendix 3, except those relating to the bending moment developed in the circular girder ring due to the self weight of the container and the hydrostatic pressure on the side of the vessel. The algebraic expressions representing the bending moments M and M are correct for the positions at which they are indicated, but these do not represent either the maximum positive or negative bending moments obtaining in the complete ring. The bending moments in rings under various conditions of loading may be deduced from the elastic energy theory, and if the bending moment diagram is developed for the ring in question it will be found that the maximum positive moment is 0.0574 Wa and not 0.025 Wa, and the maximum negative moment is − 0.05 Wa and not − 0.0462 Wa.

I do not agree with the Authors' contention that the bending moment is dependent upon radius (a) of the neutral axis of the internal circular girder section. There is some justification for this assumption when the circular girder is arranged externally and when the support reactions are taken on the outer flange or boom of the girder. In such a case the support reactions operate at a different radius from that of the loading on the walls of the vessel, but with internal circular girders the radius of the support reactions is practically the same as the radius of loading, and there appears to be no reason why the radius of the neutral axis of the girders should be considered. In these circumstances, I think it desirable to take the value of (a) as representing the radius of the shell plating. The increase in the values of the maximum and minimum bending moments and the modification with regard to the radius (a) will obviously increase the stresses in the container.

An Advocate of Welding

Mr. H. H. Hollis: This Paper is particularly welcome, following so quickly after Mr. Gill's Paper given at out last General Meeting, and I wish to congratulate the Authors for giving us so much detail of both riveted and welded construction. My views on which is the better design are well known. Fifty years ago I was interested in pressure vessels constructed with rivets. Thirty years ago I became interested in welded vessels. To-day, after years of intensive practical research work, I consider riveted gasholders, whether for high or low pressure, are out of date and belong to the ear of Stephenson's Rocket. Therefore I shall confine my remarks to the welded design. To use a Shinwellism, I don't care a tinker's cuss, or should I say, two hoots, for riveted high pressure holders. I will confine my comments to the Authors' six conclusions.

I have found no evidence that the leading British Insurance Companies desire to collaborate with gas engineers and designers.

In his Paper, given last year, Mr. Gill informed you that my Company built the high pressure holder at Market Drayton. It is 10 ft. diameter by about 62 ft. long; working pressure 100 lb. per sq.in. This holder was designed by my technical staff to meet the requirements of the A.S.M.E. Code. Full details were submitted to an important British Insurance Company. To my utter amazement, this Insurance Company refused to accept our design. We allowed for a factor of safety of five. They required 7½. Another British Insurance Company was approached, and this Company readily accepted our design. It is very desirable that there should be close collaboration between all the parties concerned, but one must be quite certain that the Insurance Companies are collaborators and not dictators. I submit that the hydraulic test is not necessary. The air test and hammering of the welded joints can be made very exacting, and safe to carry out. I agree that the trend is towards modern welded construction. Gas engineers should keep in mind that when storing gas at a high pressure absolute tightness is imperative. Should there be slight leakages, which in the aggregate only equal one hole ¼ in. diameter, gas lost per annum under 100 lb. pressure would amount to about 8½ million cu.ft., and under 200 lb. pressure, to about 12 million cu.ft.

Welding is a "newer" technique, but it has now become an "old" technique, and, what is very important these days, this technique economizes in the use of steel.

I am afraid that the Authors are treating X-ray examination at site as inexpensive. In my works we have a modern X-ray plant and equipment and have completed the X-ray work on 10 large steam boilers, working pressure 300 lb., and I can assure the Authors that to X-ray welds at site would be a very expensive business, and, in my opinion, totally unnecessary.

I agree with the Authors' final observation, with the exception of their statement: "Choice of construction should be between riveting and X-ray proved welding." Dealing with riveting first, do the Authors agree with me that no "podging" should be allowed on rivets or caulked seams when a high pressure holder is on test? I presume they have noted that "podging" is only a

temporary expedient used to make rivets and seams tight under test, and that this "podging" will not withstand expansion and contraction under working conditions.

I have already stated that X-ray examination is not necessary. It is not infallible in showing up cracks. It will show up slag inclusions, which I consider to be of minor importance. Definitely, X-ray examination will not reveal whether the welds contain residual stresses or not. Hence my contention that the hammer test is a more essential test than the X-ray.

According to the A.O.T.O. recommended Code, a joint efficiency not exceeding 80% is allowed for X-ray examination and full mechanical tests representing the seams. Without any X-ray examination, a joint efficiency of 72% is allowed, a difference of of only 8%. This is a deterrent rather than an inducement to the adoption of X-ray inspection. In the example given by the Authors the extra tonnage of steel required, using the lower efficiency without X-ray examination, is less than one-quarter of the cost of X-ray inspection.

The tests I strongly recommend are the air and hammer tests, as set out in the A.S.M.E. Code, 1943 edition, reference U-64, paragraphs (e) and (f), which are as follows:

> (e) Gas storage vessels of riveted construction which are so constructed or installed as not to be capable of safely withstanding the weight of the large mass of water required to fill them for hydrostatic test may be tested by compressed air to a pressure of at least, but which does not exceed, the maximum allowable working pressure of the vessel, provided the allowable working pressure does not exceed 80% of that which would be permitted if the vessel were subjected to the regular hydrostatic pressure.
>
> (f) Similar vessels of welded construction shall be subjected to a hammer test, if required, as prescribed in Par. U-77, except the vessels shall be empty and at atmospheric pressure, after which they shall be subjected to an air pressure not to exceed 2 p.s.i., and while under this pressure the joints shall be examined for leaks by the application of soapsuds or equivalent means. Following this soap test, the vessels shall be subjected to an air pressure not less than 1½ times the maximum allowable working pressure, after which the welded joints shall be re-examined for leaks by the application of soapsuds or equivalent means while the vessels are under an air pressure of not less than the maximum allowable working pressure."

The testing of high pressure gasholders, whether of riveted or welded design, is of supreme importance, and in my opinion a recommended Code for the welded design should be thoroughly discussed with, and approved by, the British Welding Research Association. I suggest that it would be more economical to adopt the battery system for high pressure storage, whereby smaller vessels could be used working at considerably higher pressures—I would suggest up to 300 lb.—with the added advantage that the vessels could be constructed completely in the shops and transported to site by either rail or road.

PUBLICATIONS RECEIVED

If fish is to be your dish, the neat little booklet *Fish Recipes* will provide inspiration. Published by Radiation Ltd., it contains 33 recipes embracing cooking on the hotplate, under the grill, or in the oven, with instructions on the steaming, boiling, grilling, and baking of fish. The booklet should prove popular for the recipes make only modest demands on the ration book. Copies are obtainable at a retail price to the public of 4d. each.

The Application of Switchfuses is the title of a 12-page brochure published by Cantie Switches, Ltd. The authors, W. Davies and P. J. Shipton, A.M.I.E.E., have compiled a review of major technical considerations relative to the safe and economical application of switchfuse protection. Basic features of design are outlined and reference is made to types of fuses, selection of fuses, open phase protection, and certain applications which entail special fuse characteristics. A limited number of copies will be available to engineers, on request.

The greatly increased use of instruments and automatic control in gas manufacture and distribution has created an added interest in and demand for all kinds of measuring, regulating, and precautionary devices. The latest catalogue of such equipment to reach us is No. 40 in the library of Electroflo Meters Ltd., entitled *Instruments for the Gas Industries*. Numerous photographs of actual installations and lavish colour make this a brochure of great interest. Pressure recorders, gasholder stock indicators, retort house governors, and many other instruments are illustrated and the descriptive matter is both readable and instructive. Catalogue No. 56, which is somewhat larger, contains a wider range of meters.

A useful addition to current heating and ventilating literature is the first issue of the *Year Book of the Heating and Ventilating Industry*, published by Technitrade Journals, Ltd., 8, Southampton Row, W.C.1 (5s., post 6d.), in collaboration with the Association of Heating, Ventilating, and Domestic Engineering Employers, whose offices are at Millbank House, 2, Great Peter Street, S.W.1. Its purpose is to provide in one compact volume technical, contractual, and other trade information for the use of architects, consulting engineers, surveyors, and others who are in close contact with contractors. It includes special articles on thermal insulation, district heating, technical education, and standardization, and deals with agreements, wage rates, and standard conditions of tender. A buyers' guide, list of trade names, and alphabetical and area lists of members of the Association complete the volume.

A recent address by Sir Arthur Street, Deputy Chairman of the National Coal Board, has been reproduced in booklet form by the Institute of Public Administration under the title of *The Public Corporation in British Experience* (18, Ashley Place, S.W.1, 2s. 7d. post free). The Author suggests that before an industry is nationalized it would be an advantage if an administrative blue-print was prepared by the planners showing the organization and layout of the industry; what should be managed on a functional basis; what on a geographical basis; which levels of management are suitable for collective responsibility and which for personal responsibility. The blue-print would also show how far it was necessary to standardize emoluments in cash or in kind; what the effects of certain factors would be from the national point of view, and what would be the impact on other industries. Such a blue-print is necessary because the corporation might from the start be too busy with its vital economic functions to give sufficient time to its own internal organization. "Institutions are important," concludes the Author, "but the attitude of mind of the men and women who work them is far more important. Public corporations are only a means to an end. Without a sense of public service, service to the nation and to the commonwealth of man, suffused through all their parts, they will crumble and decay in purposeless atrophy."

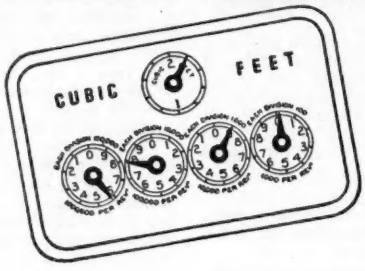
GAS UNDERTAKINGS' RESULTS

Stockton-on-Tees Gas Department.—A net loss of £3,711 for the year ended Mar. 31, is reported. Income amounted to £377,440 and working expenses £363,621 leaving a gross profit of £13,819. Other charges included interest on loans £5,678, redemption of loans £4,000, and income tax £7,852 and after deducting these there was a loss of £3,711. The balance brought forward from the previous year was £13,985.

Alliance and Dublin Consumers' Gas Company.—The Directors have announced that the accounts for the half-year ended June 30, show a deficit on revenue account of £3,317, to which is to be added £7,480 for interest on debenture stock, making a total debit on net revenue account of £10,797. Interest on investments yielded £4,021, to which is to be added a surplus of £14,122 in respect of income tax deductible from Debenture interest and dividends in excess of the net provision required for the half-year, making a total credit of £18,144. After deducting the £10,797, a net surplus for the half-year of £7,347 remains, to which is to be added the balance brought from last half-year's account of £43,330, making a total of £50,677, available for allocation. The Directors have recommended the payment of a dividend for the half-year on the Consolidated Ordinary stock at the rate of 4% per annum, which will absorb £35,348 gross, leaving £15,328 to be carried to next account.

Middlesbrough Gas Department.—The annual report of Mr. J. W. Pallister, Engineer and Manager, states that for the year ended Mar. 31, there was a net profit of £1,493 compared with £10,556 the previous year. The total expenditure was £266,667 compared with £211,694 while income was £279,922 compared with £233,779. The gross profit was £13,255 aginst £22,085. The reduced profit was chiefly due to the heavy cost of water gas manufacture a factor which would continue to operate until the new carbonizing plant was in operation. The cost of coke-oven gas had increased by 65.5% under the coal clause and this represented an increase for coke-oven gas alone of £46,722 per annum. Despite these increases the price of gas had not been raised since the war. Gas sales for the year were 2,088,992,200 cu.ft. an increase of 16% on the previous year. During the year all records for gas production were repeatedly broken and the Department had been able to satisfy all demands.

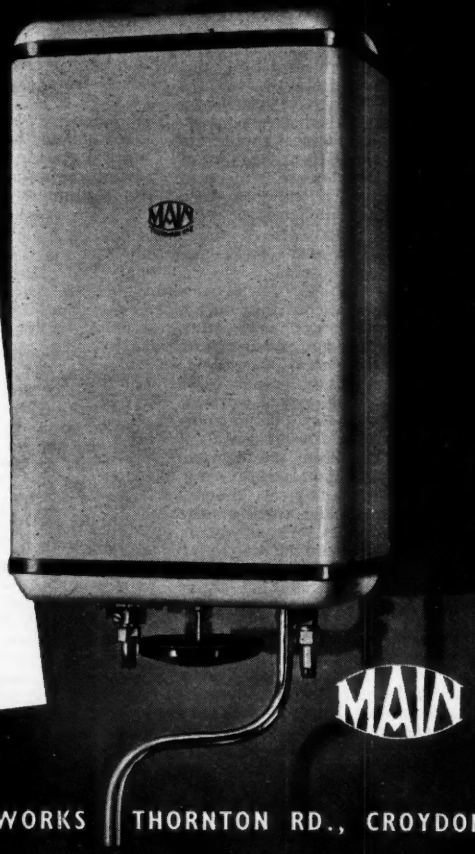
easy on the Gas



The new Thermain No. 2 is a water heater which in its design and operation anticipates and discounts the effects of the present stringent fuel economy drive, not to mention the threat of future rationing. • Its principal merits, technically, are its rapid heating-up and recovery times—a full two gallons from cold to 140° F. in about 20 minutes—due to its selected gas rate and special thermostat. Its low maintenance consumption—after heating-up, 300/400 B.Th.U./hour — is the result of heavy and effective lagging and its simple and lasting non-condensing heat exchanger. • The control is by the "Flap-Stat," which definitely ensures that gas burns at the full-on rate until the water reaches the desired temperature, at which point, *and not before*, it immediately cuts down the gas to the low maintenance rate. Conversely the gas is again turned to full-on as soon as any water is drawn off. • The new Thermain No. 2 also introduces many important long-life features and has been constructed on a principle of robust simplicity that enables it to be installed, operated, and maintained at surprisingly little cost.

BRIEF DATA

1. Capacity 2 gallons.
2. Full gas-rate, 7,500 B.Th.U. hr.
3. Maintenance temperature 140°.
4. Dimensions, overall height 27¾ in. by 11 in. wide by 8 in. deep.
5. Finished in cream enamel picked out with black.



THE **THERMAIN** No. 2 sink storage water heater

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GAS STOCKS AND SHARES

The outstanding event of the week was the suspension of the convertibility of sterling which, despite its gravity, brought a measure of relief from the uncertainty which had prevailed in the stock market for some time. The week opened with appreciable gains in British funds, but with the industrial market quiet and mainly dull. Following a week in which Stock Exchange dealings were considerably below the average the number of transactions showed a gradually rising tendency until Thursday, when the day's total dropped to 7,661 against 8,555 on the previous day and 7,666 on the previous Thursday.

There were only slight variations in the prices of gas stocks, and dealings were fewer than of late, the total for the week ended Thursday being only 230 against 283 a week earlier. Gas Light and Coke Ordinary, after slight fluctuations, closed at 19s. 9d.—21s. 9d., a decrease of 3d. on the week. Following the previous week's ex-dividend quotations, South Suburban, Tottenham, Wandsworth, and Watford and St. Albans all recovered to 100-110. Metropolitan Gas Company of Melbourne, on which a final dividend of 5s. sterling was announced, remained unchanged at 8½-10½. South Eastern Gas Corporation announced an increased interim dividend of 2½%, but the closing price of 19s.—21s. was 6d. down, though still 3d. higher than a year ago. Among the provincial undertakings, Bath and Bristol each showed a rise of two points, but Oxford, quoted ex-dividend on Aug. 14 at 175-195, dropped 15 points to 160-180. Price changes recorded during the week were as follows :

OFFICIAL LIST

Assoc. G. & W. 4½ p.c. red. cum. pref.	19/-	—21/-	— 1s.
Barnet, ord. 7 p.c. max. (xd. Aug. 20)	153	—158	— 2
Bath, cons. ord. 5 p.c. basic	100	—110	+ 2
Bournemouth, 6 p.c. pref.	115	—125	— 5
Brighton, &c., 5 p.c. std. cons. (xd. Aug. 20)	98	—103	— 2
Bristol, gen. cap. 5 p.c. max.	100	—110	+ 2
Cheltenham, ord.	100	—105	— 2
Chester United, ord.	110	—120	— 3
Commercial, 3 p.c. deb. perp.	76	— 81	— 1
Croydon, sliding scale (xd. Aug. 20)	115	—120	— 1
Derby, cons. ord.	138	—143	— 7
East Surrey, 6 p.c. cum. pref. (xd. Aug. 20)	112	—117	— 3
Gas Consolidation, ord. "A" (xd. Aug. 20)	19/6	—21/6	— 6d.
Gas Light and Coke, ord.	19/9	—21/9	— 3d.
Hampton Court, ord. (xd. Aug. 20)	98	—103	— 5
Imperial Continental, cap.	112	—117	— 2
Lea Bridge, cons. ord. (xd. Aug. 20)	140	—150	— 1
Liverpool, 5 p.c. ord.	110	—115	— 2
Mid. Southern "B" cons. (xd. Aug. 20)	68	— 73	— 2
Montevideo, Ltd., ord.	124	—129	— 1
Newcastle & Gateshead, ord.	22/-	—24/-	— 6d.
Newport (Mon.) 5 p.c. perp. deb.	110	—120	— 2
Northampton, cons.	100	—105	— 3
Oxford, cons. ord.	160	—180	— 15
Plymouth & Stonehouse, addl.	14	— 16	— ½
Portsmouth & Gosport, cons. (xd. Aug. 20)	133	—138	— 2
Primitiva Holdings, Ltd., ord.	8/6	—10/6	— 6d.
Reading, 5 p.c. max. (xd. Aug. 20)	98	—102	— 3
Romford, ord.	100	—105	— 2
Sheffield, cons. (xd. Aug. 20)	135	—140	— 2
South Eastern, ord.	19/-	—21/-	— 6d.
South Metropolitan, ord.	87	— 92	— 1
South Suburban, ord. 5 p.c.	100	—110	+ 2
Southampton, ord.	100	—105	— 2
Sunderland, ord. (xd. Aug. 20)	113	—118	— 2
Swansea, 5½ p.c. red. pref.	98	—103	— 1
Tottenham, ord.	100	—110	+ 2
Wandsworth, cons.	100	—110	+ 2
Watford & St. Albans, ord.	100	—110	+ 2
Woking District, "A" ord.	180	—190	— 5
Wolverhampton, cons. ord (xd. Aug. 20)	123	—128	— 2

GAS PRODUCTS PRICES

The London Market

August 22

The demand for coal tar products continues good and the controlled prices that have been in existence for some time remain, in general, unchanged.

Pitch Creosote Mixture, which was previously distributed by the petroleum Board, is now being disposed of in the main by Producers direct to consumers. The delivered price is comparable with the price for petroleum heavy fuel oil according to the region of delivery.

The Naphthalene produced is reserved mainly for the home market, but licences can now be obtained to export about 15% of the quantity supplied to the home market. The export price is about 80% above the corresponding home price.

Arrangements are now being made regarding the export of Pitch over the coming season and at a price considerably above the home price for briquetting Pitch.

There is also a heavy demand for Creosote for export, mostly for the U.S.A. at a price which has been fixed down to the end of the year.

The Provinces

August 23

Average prices for gas-works products this week are: Pitch, 75s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6¾d. per gall.; pure, 3s. 2¼d. Prices for carbolic acid 60's anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.) and strained anthracene oil are controlled by Government Orders. Prices for road tar are increased by one penny per gall. by S. R. & O. 1947, 177.

Scotland

August 23

Home demand continues very active.

Refined tar.* Yield to the distiller is 6d. per gall. ex works, naked. Creosote oil. Timber preserving quality,* 5¼d. to 6¼d. per gall.; hydrogenation oil,* 5¼d. per gall.; low gravity or virgin oil,† 7¼d. to 7½d. per gall.; benzol absorbing oil, 6½d. to 8d. per gall. Refined cresylic acid is 3s. 6d. to 4s. 6d. per gall. ex works, naked, according to quality. Crude naphtha,† 8d. to 10d. per gall. Solvent naphtha.* Basic maximum prices delivered in bulk, 90/160 grade 2s. 10d. per gall, and 90/190 heavy naphtha, unrectified 2s. 0½d. per gall, rectified 2s. 4d. gall. Pyridine,† 90/160 grade 15s. per gall., and 90/140 grade 17s. per gall.

* Price controlled. † Uncontrolled.

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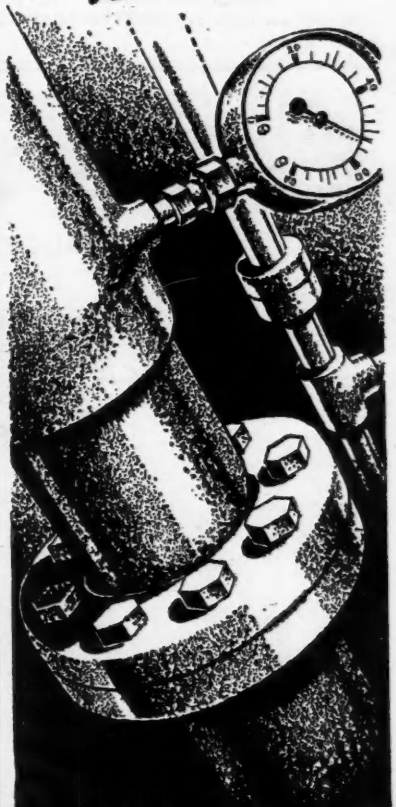
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